COLLABORATION-BASED MANAGEMENT OF PETROLEUM PIPELINE RIGHTS OF WAY IN NIGERIA

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Abstract

This thesis starts with a conceptual exploration of the challenges in the management of Petroleum Pipeline Rights of Way (ROW), within the context of public infrastructure management. Upon this basis, a holistic understanding has been developed of the concept. This understanding argues the need for Collaboration-Based Management of ROW for Petroleum Pipelines, in particular, involving the communities traversed by the pipelines as stakeholders, in order to enhance long term social, economic and environmental sustainability through their interaction with the other stakeholders: the government and multi-national oil companies.

Building upon the theoretical arguments developed, this research has proposed a geographic information system framework for demarcating ROW that is capable of continuous updating in line with new knowledge. By applying this framework, the ROW in the Federal Capital Territory, Abuja, is demarcated; and further analysis is applied that shows widespread encroachment on the ROW by other land uses. A total of 588 structured interview questionnaires were completed, five focus group discussions held and 14 key informant interviews conducted across four case study areas. Analysis of the data revealed that the pipeline project has not improved the economic situation of the people in the communities it traverses.

The empirical evidence from the case studies also suggests that vandalism thrives in the pipeline communities, because those geographically closest to the pipeline have no role in its management and the national and multi-national oil companies that have lawful authorisation over the pipelines and the associated ROW do not have the capacity to maintain real-time surveillance. Hence, there is a need for a new approach, based on a collaboration-based framework. This framework will engender the adoption of local knowledge and experience regarding the environment for the greater collective interest of the oil and gas industry, the citizenry and, by extension, the Nigerian national economy.

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Dedication

To my parents: Mr Simon I. Ekwo and Mrs Onyemowo Ekwo

and

To my darling wife: Grace and our children: Ruth, Victoria and David

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Abbreviations and definitions

Biafra	The separatist movement that fought civil war in Nigeria
Bunkering	Vandalism in marine contexts
Chappal Waddi	The highest point above sea level in Nigeria
CP	Collaborative Planning
CSR	Corporate Social Responsibility
Fulani	A pre-dominantly pastoralist ethnic group in Nigeria
Geopolitical zone	Political grouping of Nigeria, made up of six states
Governor	The Chief Executive of a State in Nigeria
GPS	Global Positioning System
Idoma	A dominant ethno-linguistic group occupying Benue trough
Infrastructure	Basic things needed for the society to function
Land Use Decree	Statute regulating how land is used in Nigeria
Local Government	The third tier of government in Nigeria
Mosimi	A major off-shore terminal in Nigeria
NLNG	Nigeria Liquefied Natural Gas
NMEA	National Marine Electronics Association
NNPC	Nigerian National Petroleum Corporation
Oba	High ranking traditional ruler in western Nigeria
Okrika	Ethno-linguistic group in Rivers State Nigeria
PHCN	Power Holding Company of Nigeria
Pipeline	A long pipe for transporting oil
Raster File	A computer file for saving geographic co-ordinates
River Benue	A major river in Nigeria
River Niger	The most important river in Nigeria
ROW	Rights of Way
State	A sub-national unit governed by a governor in Nigeria
UNCHS	United Nations Centre for Human Settlements (UN-Habitat)
Usman Dan Fodio	The leader of the Islamic Jihad of 1804 in Nigeria
Vandal Baron	Merchant that engages others in pipeline vandalism
Vandal Recruit	A person engaged to the baron for the purposes of vandalism
Vandalism	Deliberate damage to property (Pipeline)
WCED	World Commission for the Environment and Development

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CHAPTER I

INTRODUCTION

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1.1 Introduction

The purpose of this chapter is to provide an overview of how this research was initiated and conducted with the ultimate aim to explore the nature of the environmental, social and economic challenges associated with the ROW of petroleum pipelines in Nigeria and the feasibility of developing a collaboration-based framework for its management. The chapter begins by introducing readers to the background and the motivation for conducting this research. A brief overview of existing literature is presented as a prelude to the exposition of the research aim, objectives and research questions. The research methodology and data collection methods are briefly described. An outline of the contributions to knowledge expected to arise from the research is followed by a section that lays out the logical structure of the thesis, with a view to providing readers with a succinct overview of the research.

1.2 Background to the study

1.2.1 Pipeline vandalism in Nigeria

The rights of way for the petroleum pipeline in Nigeria refer to the 50m distance spanning the pipelines within which other land uses are not permitted (Brume, 2007; National Assembly Nigeria, 1990d). The petroleum pipeline network in Nigeria presently measures over 7,000km (Agbazie, 2004). The pipelines occupy vast tracts of land across the country, altering the original ecosystem and the environmental biodiversity of the areas through which they pass (Nnah and Owei, 2005).

Over the past decades in Nigeria, the pipelines and their associated rights of way have suffered a series of acts of vandalism, to the extent that the Nigerian Government have contemplated the option of burying the pipelines 12m below the surface of the earth, where they will be less vulnerable (Chika-Amanze and Edomaruse, 2007). This option, notwithstanding that it is unsustainably expensive, would also serve only as a palliative temporary measure, because the rights of way of the petroleum pipeline will still be without a stakeholder-centred management

framework. The latter is envisaged by this research as a functional lasting solution to the myriads of problems manifest in the rights of way for the petroleum pipeline in Nigeria.

Before the advent of vandalism in the 1990s, the pipelines had provided an effective means of transportation to depots and other hinterland receiving terminals for all petroleum products, across the length and breadth of Nigeria. The pipeline network was also used to transport petroleum products to export jetties and platforms, with comparative advantages in terms of cost and speed.

1.2.2 Geographic spread of pipeline in Nigeria

The Petroleum Pipeline network in Nigeria is a system of pipes designed for the haulage of petroleum-based products over long distances. These systems of pipes are designed to carry either mixed fluids or monotype fluids from one part of the country to another. The networks of pipelines in Nigeria today traverse the entire national territory. They are used to transport crude oil and its derivatives from the oilfields to the terminals from where they are either exported or used as raw materials by refining plants to produce end products. These end products include premium motor spirit, dual purpose kerosene and aviation turbine kerosene for local consumption in Nigeria, and for export to other countries within the West African sub region. Product haulage from petroleum refineries and import-receiving jetties to depots in the downstream sector of the oil industry, which are located mostly in the hinterland, is also affected through the network of pipelines. Wherever the pipes are laid, a buffer zone called 'the rights of way' is created. The pipes are buried about 1m below the earth's surface to avoid accidental contact with other land-based activities. Although this precautionary embedding is applied along most of the pipeline, recent experience has shown that its integrity and safety is incessantly compromised by acts of vandalism aiming at the theft of the petroleum products transported through it.

1.2.3 Pipeline vandalism: national spread and dimensions

The frequency of pipeline vandalism has been on the increase since the first incident was reported in the early 1990s (Onuoha, 2008b). In 1995, there were seven reported cases of vandalism in the whole of Nigeria. In 1996, this figure rose to 33, and subsequently, the figure rose to 34 and 57 in 1997 and 1998 respectively (Special

Committee on the Review of Petroleum Product Supply and Distribution, 2000:34). The issue of vandalism of the petroleum pipeline attained the level of a national problem in Nigeria in 1999, with 497 reported cases in the year of 1999 alone.

Statistics from the Nigerian National Petroleum Corporation (NNPC) show this increase in the frequency of vandalism on the pipelines across the country. The statistics show that Port Harcourt, which had recorded about 600 instances of pipeline damage owing to vandalism in 2003, was by 2006 already reporting 1,650 instances between January and September alone. Reported cases of vandalism in the Warri area escalated from only 100 to 600 during the same period. Furthermore, the Mosimi area, which recorded only 50 cases of vandalism in 2003, reported about 375 between January and September 2006. Instances of high frequency pipeline vandalism have also appeared where formerly they were rare and isolated. The Kaduna and Gombe areas have lately recorded high frequency cases of vandalism. The frequent attacks by vandals on the pipelines in these areas have also accounted for pipeline fire disasters in the last decade. This has jeopardized both human lives and the environment in the area surrounding the pipeline (Onuoha, 2008e).

The risk of pipeline vandalism imposes a situation of imminent catastrophe on the neighbouring population, and this has eroded the benefits of safe, efficient and cost-effective transportation of petroleum products through the pipeline network (Abraka, 2004). Three key factors should drive the management of the risks associated with the operation of pipeline transportation in Nigeria. These are: the economic benefits for pipeline users; corporate social responsibility towards employees and third parties, which includes the communities traversed by the pipelines; and government regulations, as spelt out in various petroleum pipeline laws (Brume, 2007; National Assembly Nigeria, 1990d; National Assembly Nigeria, 1990c). The consequences of poor management of the rights of way for the petroleum pipeline range from the loss of thousands of lives; fire outbreaks on vandalised pipelines; and pollution of the environment; to loss of earnings by the government and the scarcity of refined petroleum products in the country.

Several different types of pipeline system exist in Nigeria (Agbazie, 2004). These are those meant for transporting dry natural gases from Gas Plants to Liquefied Natural Gas Plants at Bonny and Escravos; those meant for the transport of crude oil and its

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different derivatives; and those used for channelling crude oil and its associated water and gas from the oilfields to the export terminals at Bonny, Qua Ibno, Forcados, Escravos and Brass.[1] Other pipeline systems are used for moving refined products from Port Harcourt 1 and 2, Warri and Kaduna Refineries to the distribution depots owned by the Product Marketing Company depots all over Nigeria.

1.3 Global challenges in pipeline management

It has been proven that transnational pipeline infrastructure is the most effective, safe and environmentally friendly means of transportation for petroleum products over long distances, both nationally within the geographical boundaries of countries and internationally across national boundaries (Dey, 2003). As is the case in Nigeria, all over the world networks of pipeline infrastructure have become economically vital (Chao-feng and Mei-ting, 2009).

However, in many parts of the world, the advantages gained by transporting petroleum products in pipelines have been constrained by external interferences, both natural and man-made (Dey *et al.*, 1996). In Nigeria, vandalism has necessitated road haulage for petroleum products hitherto transported through the pipelines. This development has increased the volume of traffic on the roads (Goodfellow and Haswell, 2006). The increase in road use by heavy duty vehicles translates into a reduction in the road's life span, given that they were not originally built to withstand the pressures exerted by heavy vehicles transporting petroleum products across the country (Goodfellow and Haswell, 2006; Chokor, 1993).

1.3.1 Management challenges in America

The network of pipelines has become the dominant means for the bulk haulage of petroleum products in America (Morrow *et al.*, 2006). In that country, elaborate networks of pipelines within and beyond national boundaries are widely used for bulk haulage of petroleum products (Morrow e*t al.*, 2006; Cherry, 2004; Ronen, 1995). The economies of many countries in North and South America have become heavily dependent on the uninterrupted operation of the network of pipelines transporting petroleum products within and across national boundaries (Dey, 2004).

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[1] Bonny, Qua Ibno, Forcados, Escravos and Brass are native oil producing communities in the Niger delta region of Nigeria.

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In the USA, over 68% of petroleum products are transported by means of pipelines. This has translated into savings in cost and man-hours and has also guaranteed product availability across the country (Dey, 2004). The widespread use of pipelines for transnational haulage of petroleum products in the Americas has, however, not been without some challenges. The challenges have been classified as natural, operational and related to the threat of terrorist attack (Moteff, 2005).

Natural challenges to the operation of the pipelines as effective means of product haulage across America are presented by tectonic activities, which account for the majority of disruptions in petroleum product transport by pipeline. Damage to the pipeline owing to operational factors ranks second on the scale of challenges in the Americas (Moteff, 2005; Rinaldi *et al.*, 2002).

Damage to the pipeline owing to terrorist attack is rare in America (Moteff, 2005). However, simulations carried out after the 9/11 attack suggest that terrorists may target critical state infrastructure, such as the pipeline network, in order to cause large scale disruption to the supply of vital petroleum products. As reported by Moteff (2005), the 9/11 Commission in the United States not only called for a comprehensive evaluation of the management plan for all critical national infrastructure, but also recommended heightened efforts to protect the various modes of transportation; and the allocation of federal assistance to state and local governments in furthering efforts to safeguard infrastructures nationally.

The pipelines, like other national infrastructures, are so large, complex, and intertwined that understanding how they work, how they fail, and how best to protect them is a significant problem in America (Smith, 2002). Rapid advances in interconnectedness have also created major challenges for safeguarding critical infrastructure such as pipeline networks (Anderson, 2002). A variety of advanced technologies is being developed to enhance planning, designing, managing, operating, and maintaining all aspects of national public and private facilities of a linear nature (such as pipeline) in the United States (Roper, 2003). A key success factor in the management framework for critical linear infrastructures has lain in the co-operation of the communities that they traverse.

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A strip of land containing one or more pipelines, usually about 18 m (60 ft) wide, is known as the pipeline right of way (ROW) in Canada (Share, 2004). The width of the ROW creates a space that allows workers to gain access to the pipeline for inspection, maintenance, testing or emergency purposes. It also identifies an area where certain activities are restricted, to protect the public, landowners, their families and other users from the potential hazards which pipeline failures could cause (Roper, 2002; Roth and Schick, 2000).

1.3.2 Pipeline management challenges in Canada

In Canada, permanent pipeline markers are located on roads, railways and other intersecting infrastructure, along the rights of way. This is meant to show the approximate location of the buried pipelines, so that activities that could have an impact on them are avoided. The depth and location of the pipelines vary within the rights of way. The rights of way traverse many kinds of ecosystems ranging from river crossings and cultivated fields to sub-arctic tundra and urban areas (Dey, 2003).

Figure 1: Pipeline rights of way in Canada

Source: Enbridge at http://www.enbridge.com/pipelines/right-of-way/

As seen in Figure 1, in addition to the immediate environment where the pipeline is located, Canada's National Energy Board has established a 30-metre safety zone on either side of the right of way, in order to protect the pipeline and the environment. Excavation or the use of explosives within the 60-metre safety zone is prohibited and, when it happens, must be reported to the authorities for immediate action (Jones and Holt, 2002). The analyses above seem to suggest that the challenges in the

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management of the rights of way of petroleum pipelines in North America are those of early recognition and management of natural hazards such as tsunami, volcano and landslide.

1.3.3 Pipeline management challenges in India

Dey (2004), after a review of the various modes of transportation, concluded that the pipeline provides the most effective means of petroleum product haulage and the safest mode of transporting bulk petroleum products in India. Failure rates of product transport by pipeline in India are minimal compared to those associated with rail and road transport, which often record severe failures with consequent damage to the environment (Ghose and Paul, 2008; Dey *et al.*, 1996). However, contrary to the situation in Nigeria, challenges in the management of petroleum pipelines in India are essentially natural, rather than due to vandalism, they are mainly due to geological factors such as landslide, earthquake and other tectonic activities within the earth's crust (Dey, 2001).

1.3.4 Pipeline management challenges in the Caspian region

In the Caspian region, particularly in Azerbaijan, Kazakhstan and Turkmenistan, pipelines are the subject of international politics (Starr and Cornell, 2005). The control of activities around the pipelines involves transnational interests extending across the region to Europe (Stauffer, 2000). In addition to its economic benefit to the people of Azerbaijan, the Baku-Tbilisi-Ceyhan Pipeline is a geopolitical asset for the country, because its sustainable management engenders interests beyond its national boundaries (Stauffer, 2000). Pertaining to an infrastructure of national and intercontinental relevance, the Bake-Tbilisi-Ceyhan pipeline network route enables the nation to rely less on foreign territories for exporting its oil and is the foundation of new economic, political and security links with Turkey, and subsequently, with Western Europe (Starr and Cornell, 2005). This ensures that high risk activities near and around the pipelines are conducted under the strict supervision of constituted authorities. Challenges in the management of the pipeline in the Caspian region relate to strategic transnational political interests aimed at controlling the movement of petroleum products out of the region to Europe and other parts of the world (Cornell and Ismailzade, 2006).

1.4 Origin of the petroleum pipeline in Nigeria

The origin of petroleum pipeline development in Nigeria is closely associated with oil exploration activities which started in 1908 although no oil discoveries were reported before the exploration was disrupted by World War I (NNPC, 2002; National Assembly Nigeria, 1990e). Post World War I, oil exploration activities did not recommence until decades after the 1914 amalgamation of the Southern and Northern Protectorates of Nigeria under the Colonial British Administration. This culminated in the enactment of the Mineral Oil Ordinance of 1947 (National Assembly Nigeria, 1967.). The ordinance limited the granting of oil exploration licences and leases to British Subjects and Companies for the greater part of the post World War I period (NNPC, 2002). In 1937, a Dutch Company then known as Shell D'Arcy was awarded exploration rights over the whole of Nigeria, a development that restarted sustained aggressive exploration activities prior to renewed interruption of exploration activities due to the hostilities of World War II (1939-1945). The post World War II era witnessed a boom in oil exploration activities in Nigeria (Freund, 1978). Shell D'Arcy resumed exploration activities over the whole of Nigeria in collaboration with British Petroleum, in a joint venture known as Shell-BP. Shell-BP later partially relinquished its exploration rights, limiting its acreage by 1951 to one sixth of the whole country, in an area that was mainly concentrated in the Niger Delta.

Mobil took advantage of the acreage of the country relinquished by Shell-BP to acquire exploration rights over the Sokoto Basin in 1955, using the trade name, Mobil Exploration Nigeria Incorporated (NNPC, 2002). Mobil, like Shell-BP, initiated extensive exploration activities but these did not lead to the discovery of oil. However, the activities of Shell-BP led to the first discovery of oil in commercial quantities in the Oloibiri Community of the Niger Delta Region of Nigeria in 1956 (Pinto, 1987). This discovery culminated in full scale commercial oil exploitation and, in 1958, the associated building of pipelines to transport the crude oil produced.
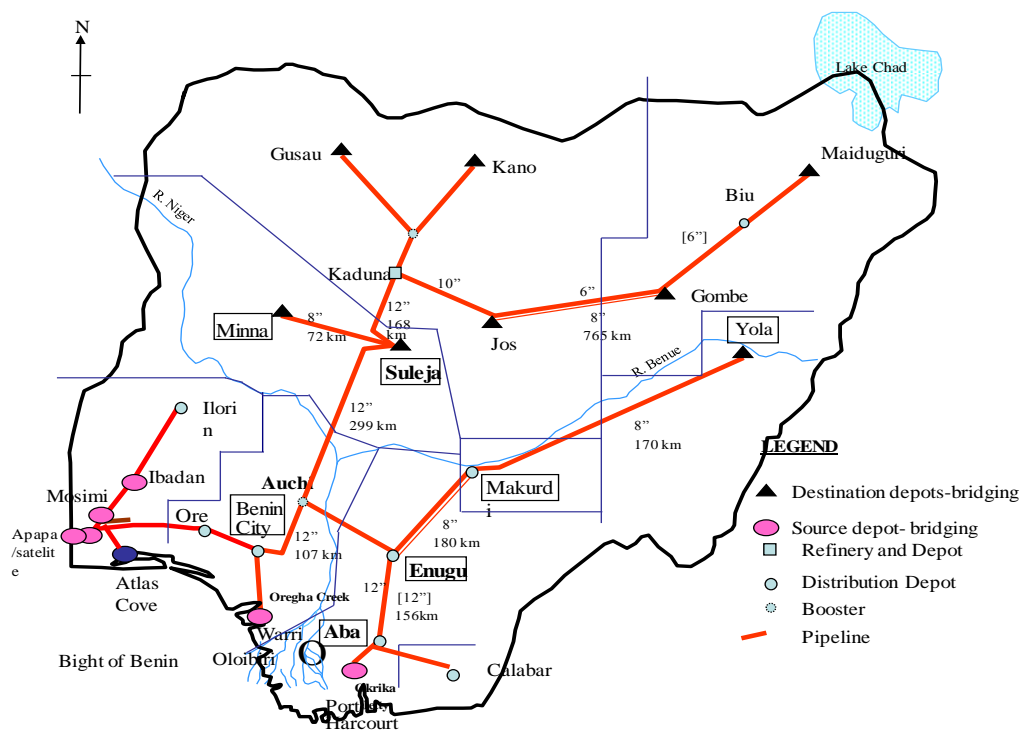
Figure 2: The network of pipelines in Nigeria

Source: Nigerian National Petroleum Corporation

Construction activities for the network of pipeline shown in Figure 2 started with the discovery of oil in commercial quantities in Oloibiri in 1956. The subsequent full scale commercial exploitation that followed in 1958 by Shell-BP then expanded to all parts of Nigeria (Onuoha, 2009; NNPC, 2002). In Oloibiri, production commenced to the tune of 5,000 barrels per day immediately after the discovery and this necessitated the laying of pipelines to transport the crude oil from the oil field to the coast for export (Jike, 2004). Pipe laying for crude oil transportation at the time naturally created a buffer zone which is now protected statutorily and called 'the rights of way for petroleum products pipelines in Nigeria' (Brume, 2007; National Assembly Nigeria, 1990d).

1.4.1 Expansion of petroleum pipeline rights of way in Nigeria

The relative economic advantage, administrative convenience and speed of petroleum product transportation in countries like India, Britain and Canada by means of the pipeline gave the impetus for rapid post-oil-discovery pipeline

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expansion activities in Nigeria (Nwilo and Badejo, 2006). After the discovery of oil at Oloibiri, four other multinational oil companies acquired operation licences and began operations from 1960-1966, expanding the scale of exploration and exploitation activities and yielding commensurate increases in the expansion of pipeline infrastructure and the associated rights of way in the country (Atsegbua, 1999).

The entrance of more oil companies into the exploration activities at the time introduced a relative competition in the oil industry which led to the granting of the first sets of offshore licences for oil prospecting. As a result, new entrants joined the oil industry in Nigeria, namely Texaco and Gulf Oil (now Chevron) in 1961; and Safrap (now TotalFinaElf) and Agip in 1962 (NNPC, 2002). The four new entrants and Shell-BP all implemented policies of aggressive production expansion that relied heavily on pipelines for transportation of products to the export terminals. Expansion of the pipeline network also created, simultaneously, the buffer known as the rights of way (Omeje, 2006b; NNPC, 2002). Production outputs further increased steadily to 400,000 barrels per day by 1966 and by 1970, had reached one million barrels per day, with a commensurate extension of pipeline and its associated rights of way to connect the new oil fields.

Exploration and production activities in the oil industry in Nigeria from the time of oil discovery in 1956 up to 1970 was completely dominated by foreign oil companies, with Nigeria as a country only collecting Royalty and Tax from the foreign operators at the time (NNPC, 2002). The expansion of the oil pipeline at the time was skewed towards the export terminals. However in 1971, Nigeria joined the Organisation of Petroleum Exporting Countries (OPEC) and in the same year, the Nigerian National Oil Company was created. Thereafter, encouraged by its OPEC membership, Nigeria began active participation in its national oil industry (Abiodun, 1974).

Today, Nigeria could be said to have a mono-product economy which greatly depends on the petroleum industry for survival. From a humble beginning, the petroleum industry in Nigeria has risen to the enviable position of being the sixth largest in the world. Similarly, Nigeria's oil sector has developed into a vast domestic industrial infrastructure, consisting of over 300 oil fields, 5,284 wells, over 7,000km

of pipeline, ten export terminals, 22 petroleum storage depots, 275 flow stations, ten gas plants, four refineries and a massive liquefied natural gas (LNG) project, largely located in the gas-bearing Niger Delta Region of the country. To enhance the distribution of crude oil products from the Niger Delta to other parts of the country, the network of oil pipelines has extended to link all the states at strategic locations. The network of pipelines consists of multi-product and crude oil pipelines across the country, linking the 22 petroleum storage depots, the four refineries at Port Harcourt (I and II), Kaduna and Warri, and the off-shore terminals at Bonny and Escravos. Other installations also connected by the network of pipeline include the jetties at Atlas Cove, Calabar, Okirika and Warri.

The multi-product pipelines are used to transport petroleum products from the refineries and import-receiving jetties to storage depots located all over the country. The storage infrastructure, which consists of 22 loading depots linked by pipelines of various diameters ranging from 4-15 cm (Onuoha, 2008b), has a combined installed capacity of 1,266,890m^3 for premium motor spirit (PMS), 676,400 m^3 for dual purpose kerosene (DPK), 1,007,900 m^3 for automotive gasoline oil (AGO), and 740,000 m^3 for aviation turbine kerosene (ATK).

Around the world, the rate of failure owing to petroleum product transportation by rail and road was very high in the 1960s-70s with negative consequences to the environment and loss of life (Ikelegbe, 2006a). As a result, the relative safety, efficiency and cost effectiveness of petroleum product transportation by pipeline over road and rail led to the rapid expansion and growth of pipeline networks in India and other parts of the world, including Nigeria (Brume, 2007; Dey, 2004).

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1.5 Aim and objectives

1.5.1 Aim

The aim of this research is to explore the nature of the environmental, social and economic challenges associated with the ROW of petroleum pipelines in Nigeria and the feasibility of developing a collaboration-based framework for its management.

1.5.2 Objectives

The broad aim of this research stated above is achieved through the following specific objectives.

i. To demarcate the ROW of petroleum pipelines in Nigeria using geographic information systems software.
ii. To carry-out spatial analyses to determine the land uses that have encroached on the ROW of the pipeline in Nigeria, drawing from case study analysis;
iii. To examine the spatial character and spread of the problem of petroleum pipeline vandalism in Nigeria.
iv. To make a cross country analysis of the spread and prevalence of the problem of pipeline vandalism in Nigeria.
v. To examine the issues around the impediment to interaction between communities separated by pipeline ROW in Nigeria.
vi. To examine the host-community-based social and environmental problems associated with the pipeline and it's ROW in Nigeria.
vii. Making of policy recommendations for a host-community-centred, collaboration-based framework for the management of petroleum pipeline ROW in Nigeria.

1.6 Scope of the research

Using the case study approach, this study conducted detailed surveys on petroleum pipelines, their associated rights of way, and the communities they traverse, in four carefully selected case studies in Nigeria, namely: Abuja and Otukpo in the Northern Region and Enugu and Port Harcourt in the Southern Region.

1.7 Case study selection

The four case studies were selected based on the geopolitical[2] zone groupings of Nigeria. Two case studies were selected from the northern and southern regions of the country respectively. Selection of the case studies was informed by the two pilot studies undertaken by the principal investigator preparatory to the substantive fieldwork. The pilot studies showed that vandalism was recorded in higher frequencies in the southern region of the country compared to the north.

Abuja was selected as one of the case studies from northern Nigeria because of its status as Nigeria's new purpose-built administrative and political capital, with all geopolitical zones of the country represented in its population. Otukpo in the Idoma[3] Senatorial District of Benue State, northern central Nigeria, was selected as the second northern case study, based on the findings of the pilot studies, which revealed cases of vandalism and environmental pollution in the rights of way communities in the area.

Enugu, in the south eastern zone of the country, was selected based on its position as a major pipeline distribution hub with very high recorded cases of vandalism. Port Harcourt was selected because of its status as the traditional headquarters of the country's oil producing Niger Delta Region.

1.8 The research problem

Petroleum pipelines in Nigeria measure about 7,000km in length (Agbazie, 2004; NNPC, 2002). The width of their ROW is 50m (Brume, 2007). The pipelines and their associated ROW are spread across the length and breadth of Nigeria. The network of pipelines cuts across all the geographical zones of the country, from the coastal mangrove forest region of the south, through the Guinea savannah region in the middle belt, to the Sahara region in the northern region (Nnah and Owei, 2005).

In some of the areas affected by the pipelines, the original ecosystem of the ROW has been permanently altered, creating myriads of social, economic and environmental problems. These problems range from impediments to inter-

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[2] A geopolitical zone in Nigeria is the division of the 36 states of the Country into six zone groups with geographical and political affinity.
[3] Idoma is a major Ethno-linguistic group in the North Central geopolitical zone of Nigeria.

community interaction, violent crime and pollution, to issues of land use. These problems have generated conflicts which result in vandalism to the pipelines and encroachment on their ROW with a number of negative consequences in Nigeria (Odoh and Iyi, 2005).

The absence of a collaboration-based, nationwide management framework for the ROW has created a void within which the above-stated problems are proliferating (Nwokeji, 2007; Nnah and Owei, 2005). As stated above, the problem of petroleum pipeline rights of way management, which affects every aspect of national life in Nigeria, has manifested itself in widespread pipeline vandalism, owing to general discontent among the communities affected by the petroleum project. Over 500 lives were lost in one pipeline vandalism incident and the inferno that ensued in an incident in Abule-Egba[4] in 2008 (Fadeyibi *et al.*, 2009). Pipeline fires caused by vandalism also occurred twice in two weeks in the Delta State, causing extensive environmental damage and loss of life (Amazie, 2007; Brume, 2007; Ogundele, 2007). This research aims to explore the social, economic and environmental challenges associated with the pipeline and it's ROW in Nigeria and the feasibility of developing a collaboration-based, stakeholder-centred framework for managing the rights of way of the petroleum pipeline in Nigeria.

1.9 Research philosophy

The research encapsulates the principle of collaborative planning as the platform for a host-community centred framework for engendering consensus-building participation among public and private stakeholders towards sustainable management of ROW in Nigeria (Brume, 2007; Healey, 2003). The research undertakes an interpretivist evolutionary theoretical exploration of the concepts of corporate social responsibility and sustainable development through a collaborative planning approach, as a tool for mobilising host-community interests and other stakeholders, for a collaboration-based management of the ROW of petroleum pipelines in Nigeria.

The research conceives the collaboration-based framework for the management of ROW as requiring that the present strict statute-based structure of decision-making

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[4] Abule -Agba is a suburban area of Lagos State in Nigeria.

arrangements for the management of the pipelines be devolved. This devolution of decision-making is in order to create a role for, and empower, the host-communities, and other non-governmental stakeholders, in the management of the pipelines. A definite role is conceived for individuals in the communities in the form of employment opportunities, translating into empowerment of the people through their community groups, which then manifest in participation in decision making and review of appropriate policies whose implementation benefits the majority of the people. This also entails the benefit of educating vulnerable individuals in ROW communities through verifiable, transparent programmes of inclusiveness towards the people (Simonovic and Bender, 1996; Getz and Jamal, 1994).

Petroleum pipelines traverse institutionally fragmented spatial terrain and cut across a varied tableau of societal fragmentation in Nigeria (Nnadi and Cmilt, 2007; Pinto et al., 2003; Roche and Humeau, 1999; Healey, 1997b). An intricate interplay of cultural multiplicity is represented in the diversity of community interests that trail Nigerian pipelines' ROW. Some of these interests transcend local, regional and, in some cases, national boundaries (Brewer *et al.*, 2000; Jones *et al.*, 1997). A spatial collaboration-based management framework for the ROW through the real time utility of geographic information systems can provide a solution to the problem (Kyem, 2000; Klosterman, 1999). Principles of collaborative planning are used to engender consensus from communities, public authorities and the organised private sector to achieve a cross-sector convergence of interests for the protection of the pipelines (Berkes *et al.*, 2007; Chang and Li, 2007; Brewer *et al.*, 2000). The collaboration-based framework, supported by the use of geographic information systems, is used to demarcate ROW which were lost owing to the decades in which there was no effective management instrument.

It is hoped that the role of the different stakeholders within the collaboration-based management framework, giving emphasis to mutual gain, would engender the symbiosis of interests from all the stakeholder parties regarding the ROW. This should create a relationship in which the public authority, as catalyst and coordinator, brings together other participants and actors in collaboration-based management, while monitoring the progress of improvement towards the overall strengthening of the process.

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1.10 Research methodology

The research was conducted using a combination of empirical and theoretical methods. A unit of the global positioning system (GPS) was used to capture ground control points along a 23 km length of pipeline. The GPS unit was connected to a laptop computer using the National Marine Electronic Association (NMEA) protocol. The route of the pipeline was then followed to capture and transfer a stream of acquired GPS co-ordinates into a Dell laptop computer for storage in a vector file.

By opening and re-playing the vector file, the route taken by the pipeline was automatically plotted, depicting the ROW. Data on the social, economic and environmental problems associated with the rights of way and the role of host communities in its management were obtained through the administration of questionnaires to communities in the selected case study areas. Key informant interviews were also held with leaders of community-based organisations, government officials and representatives of national and international oil companies with responsibilities relating to the pipelines and their associated ROW in Nigeria.

1.11 Contributions to knowledge

Building upon preliminary readings and the literature reviewed, this study first refined the concept of Collaboration-Based Management for Petroleum Pipeline ROW to embrace all aspects of sustainability in petroleum infrastructure management and propounded a rationale for stakeholder collaboration in public infrastructure management as responding to the need to promote sustainability in social, economic and environmental terms. Collaboration-based management of the ROW is about harnessing all contending interests in the pipeline to facilitate consensual efforts towards its socio-economic and environmental sustainability, for the benefit of all stakeholders. The study specifically made practical and theoretical contributions to knowledge.

In terms of its practical contribution, the study developed a GIS based template for demarcating the ROW of petroleum pipelines in Nigeria. This template which has been successfully demonstrated across a 23km length of the ROW in Abuja can be repeated across the over 7,000km length of the pipelines in Nigeria is also capable of

continuous and continuously updating knowledge. The data set generated through this template is useful for the auto-tracking of pipeline from a helicopter. Spatial analyses using digitising techniques produced the actual extent of encroachment on the 23km stretch of pipeline traversed on foot during the fieldwork.

Drawing on this, the study advances three theoretical arguments. Firstly, it argues the need for collaboration in the framework for managing the ROW, which should include all stakeholders with interests in the pipeline network. In this sense, it contends that attempts to restrict the participation of any stakeholder in the management framework will bias the concept of Collaboration-Based Management. The second argument developed is that corporate social responsibility can find expression in collaborative planning with the goal of sustainable development and, particularly, within the purview of Agenda 21. This would operate to mitigate the harsh socio-economic and environmental conditions that underpin the myriads of problems in ROW communities. The third argument relates to the question of who benefits from the Collaboration-Based Management of pipeline ROW, where it is contended that a fundamental feature is the recognition of all stakeholders within an all-inclusive framework which would ensure justice for all interests.

The theoretical arguments presented in chapter two are normative in nature, following the traditions of planning as a discipline. Drawing from these arguments, this research maintains that understanding the holistic meaning of infrastructure - in this case, the petroleum pipeline and its associated ROW - and re-defining it to serve developmental purposes for all stakeholders, is essential for the effective management of critical national infrastructure. Local and national development activities need not only to address economic growth but also to balance social and environmental sustainability. Infrastructural development planning needs to facilitate cohesive collaboration between all stakeholders for its post-implementation management, in order to promote a higher quality of place in the communities where it is located.

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1.12 Structure of the thesis

This thesis is divided into nine chapters. In this introductory chapter, an overview of the study has been presented. Drawing on the background to the study and initial review of literature, the research aim, objectives and problem were identified. The research problem was articulated and the overarching philosophy of the study was presented. The research methodology employed for study was outlined and its contribution to knowledge presented.

In order to base the research on a sound theoretical foundation, chapter two provides a detailed review of relevant literature on the current state of the debate, ranging across issues of corporate social responsibility, collaborative planning and sustainable development within the context of the rights of way communities in Nigeria. By critically examining the literature, the research problem, philosophy and methodology are further embedded in theory and refined to highlight the revealed gap in knowledge which this research has aimed to fill. In chapter three, a global perspective on the problem of pipeline management is presented.

A detailed context for the research setting is presented in chapter four. This chapter starts with a spatial contextualisation of the pipeline and its associated rights of way in Nigeria by tracing its modest beginnings in 1956 to the discovery of oil in commercial quantities at Oloibiri Community in present day Bayelsa State. It then explores its steady expansion, which, at the time of the fieldwork for this study, measured over 7,000km and traversed the whole geographical landscape of the country.

Chapter five presents a detailed discussion of the choice of the research methodology and the rationale through which the adopted research strategy, approach, data collection techniques and instruments of analysis are justified. The process of designing the research and a presentation on the criteria and process of selecting the case studies are also discussed in this chapter, along with the limitations of the research method and data collection techniques.

In chapter six, a presentation of the spatial section of the primary data is made. Details of the ground control points acquired by walking a 23-kilometre length of the pipeline from Kwali to Abaji in the Federal Capital Territory of Nigeria are

presented. Through critically analysing the spatial data, the research achieves its first two objectives, relating respectively to demarcating the petroleum pipelines' rights ROW and determining the land uses that encroach on these. Also found in this chapter is a template for demarcating the petroleum pipeline and its associated ROW which was designed and implemented in Abuja. This template was also simplified for extrapolation across the more than 7,000km of pipeline in Nigeria and further global application in demarcation and management of linear infrastructure.

In chapter seven, further findings from the four case studies are presented. Specific issues relating to the stated research objectives and questions are identified and presented. The extent of socio-economic and environmental problems and the issue of impediments to inter-community interactions are identified and presented in this chapter.

Chapter eight summarises the research findings within the theoretical context. This is followed by a presentation of the loss of revenue suffered nationally owing to pipeline vandalism, both in terms of product losses and costs of repair. Furthermore, in chapter eight, the findings of the research are discussed in order to bring out the salient issues regarding the study's overall contribution to knowledge and its implications for public policy.

Chapter nine concludes the research. The distinctive policy implications for the various stakeholders concerned are extrapolated based on the findings and discussions. Drawing from the theoretical contributions and practical applications derived from the research, detailed implementation strategies are articulated for the achievement of the collaboration-based management of petroleum pipeline ROW in Nigeria.

CHAPTER 2

LITERATURE REVIEW

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The preliminary review of the literature and the pilot surveys presented in chapter one indicated that the problems of petroleum pipeline vandalism, and the associated challenges in the quest to manage the ROW, are of increasing academic interest. These reveal the need to develop a holistic theoretical understanding of the nature of the challenges in the management of petroleum pipelines and their associated ROW. This chapter is designed to provide a detailed review of theoretical approaches to the management of the social contract relationship between businesses and government stakeholders on the one hand; and non-governmental and host-community stakeholders on the other. In addition, it explores how these relationships relate to the particular environmental management and collaborative planning issues associated with linear infrastructures, with a particular focus on the specific challenges associated with the management of pipelines and their ROW.

2.2 The theoretical framework

In articulating the theoretical foundation for the research, this chapter begins with an exploration of the concept of corporate social responsibility within the framework of sustainable development. Business corporate social responsibility has been found to aim essentially to achieve the goal of environmental sustainability. This is encapsulated in the doctrine of sustainable development for the host community and other stakeholders. This chapter argues that collaborative planning is a medium through which the declared fiduciary social contract between a business and its host community can be delivered to ensure that as the business achieves its goal of profit maximisation, the host community also benefits through investments in social capital and environmental management. The chapter concludes with the submission that the corporate social responsibility objectives of businesses - in this context, oil and gas companies operating the network of pipelines in Nigeria - can be expressed through the instrument of collaborative planning to achieve the goal of sustainable development.

2.3 Corporate Social Responsibility

Corporate social responsibility is the commitment of businesses to the sustainable economic development of their host communities and of society at large, while also benefiting the lives of the workforce and their families (Welker, 2009; Dahlsrud, 2008). It is the concept whereby companies integrate social and environmental concerns in their business operations and in their interactions with their stakeholders on a voluntary basis, to ensure a mutually beneficial relationship between the business and the society in which the company conducts its business activities (Hess *et al.*, 2002; Pava and Krausz, 1996).

Corporate social responsibility has always been the operational dimension of multinational corporations' promise of development in their host communities, suggesting a means of effecting environmental justice for the people affected by their operations (Garriga and Melé, 2004). Historically, the global oil sector has been among the leading advocates of corporate social responsibility; but at the same time, it has also been responsible for much global environmental problems (Frynas, 2005). The last two decades saw the importance of corporate social responsibility as a central theme of, on the one hand, the relationship between companies and the communities within which they operate; and on the other hand, of the relationship between the companies and their employees (Garriga and Melé, 2004). The understanding of environmental justice has broadened in recent years in an attempt to address the social, ecological and cultural externalities of companies in host communities (Bowen, 2002; Gauna, 1995).

The issue of corporate social responsibility and sustainable environmental management arising from multinational corporations' way of conducting business has attracted considerable attention from researchers, and this has resulted in a growing number of academic publications. However, in many cases the relationship between these two concepts is not clearly defined, and neither is it clear how they might be contextualised within a collaborative framework to promote sustainable development in host communities. In order to lay the theoretical foundation for the current research, it is therefore necessary to begin by clarifying their meanings and the ways in which they interact.

2.3.1 Debate on Corporate Social Responsibility

According to (Frynas, 2005), oil and gas companies now attach more importance to their social, economic and environmental impacts on the host communities where their operations take place. These impacts range from marked changes in a community's means of subsistence and the transformation of community ways of life to the destruction of a community's environment and amenities. These negative externalities have been repeatedly caused by operations of companies in the oil and gas sector around the world (Jenkins and Yakovleva, 2006), with many host communities the world over and their tenant oil companies reportedly living in two different worlds socio-economically, even though they may be located side by side in the same geographical vicinity (McAdam and Leonard, 2003). The last two decades have seen an increase in the recognition of corporate social responsibility as an equitable way to approach business. This has brought to the fore the recognition that, in addition to being responsible to their shareholders and driven by the profit motive, business concerns around the world, especially multinational corporations, also have a responsibility to share the benefits they attain with their host communities (Winston, 2002). However, the substance and effectiveness of corporate social responsibility initiatives have been questioned (Frynas, 2005). The debate around corporate social responsibility in the Nigerian oil and gas sector has often alluded to the fact that there is discord between the oil and gas companies and the communities in which they conduct their business (Warhurst, 2005). Analyses of the place of corporate social responsibility in the business and operational policy thrust of operating oil companies aim at identifying the disconnection, and leading to a synthesis from which appropriate policy recommendations, synchronising the data from all stakeholders, will flow to promote a mutually beneficial overall relationship between host communities and companies, and obviate the negative environmental externalities of their operations (Newell and Frynas, 2007; Rondinelli and Berry, 2000).

2.3.2 The instrumental concepts debate

The debate about social corporate responsibility has been conducted within different schools of thought. Instrumentalist theorists argue that corporate social responsibility is the means to mitigate profiteering by corporate organisations (Garriga and Melé, 2004). According to this school of thought, any supposed activity should be accepted if its object is the creation of wealth for the use of the society. The central assumption in this approach is that corporations are the instruments of wealth creation; hence, wealth creation is their only social corporate responsibility. This school of thought, according to Schwartz and Carroll (2003), only considers the economic aspect of the interactions between corporate organisations and their host communities. Symbolic of this school of thought is the contested view of Friedman et al., (2005) which contested that the classic interpretation of the corporate social responsibility of the business in the society and particularly their host community is the maximisation of profits for a higher return on investment to the shareholders provided this is done within existing national legal frameworks and the ethical custom of the people.

Instrumental theorists have enjoyed considerable acceptance over a long period of time among the promoters of economic growth (Scherer and Palazzo, 2007). To this school of thought, corporate social responsibility construed within a purview is focused on the economic development of host communities (Lee, 2008). The proponents of this established theory, who tend to be biased towards the rich and powerful constituencies of interest, promote the position that corporate social responsibility is instrumental for the long-term economic development of the host community (Siegel and Vitaliano, 2007). Instrumental theorists would easily accept any definition of corporate social responsibility as long as it embraces the goal of business as wealth creation and a greater return on investment for shareholders (Jenkins, 2004). They hypothesise that business must engage in corporate socially responsible activity wherever the anticipated benefits are greater than the costs. This approach advances the maximisation of returns to shareholders as the supreme consideration in corporate decision making, irrespective of any externalities that decision may have for the environment (Aguilera *et al.*, 2004).

Moir (2001) suggested that instead of accepting a definition that constrains development, corporate social responsibility is the obligation of the business to advance the economic interest of its shareholder stakeholders. In this context, Aguilera *et al.* (2004) suggest that business organisations are increasingly engaging in corporate social responsibility initiatives, and thereby exhibiting the potential to exert positive social change for wealth creation. They present a model that integrates theories of micro-level organisational justice, corporate governance and macro-level variants of capitalism. According to Aguilera *et al.* (2004), the profit motive is at the very heart of the corporate objective of the business and of utmost importance to shareholders is the drive for greater return on investment; however, this is achieved through the notion of social investment in a competitive context. They apply a model of competitive advantage in determining the approach of businesses to the question of corporate social responsibility, concluding that the attitude of businesses is to construe corporate social responsibility as consisting of investment in areas that confer advantage to them in a competitive context. In this regard, it has been argued that investing in philanthropic activities could be a mechanism for businesses to improve their competitive advantage by creating social values that could entrench the organisation's profitability in the host community better than individuals or governments could (McWilliams and Siegel, 2001). As Logsdon and Yuthas (1997) noted, when the philanthropic activities of corporate organisations are tailored towards their business objectives, they build an environment for the creation of more wealth than when they put such efforts into other activities that are not directly related to their corporate mission. Thus, for example, we might assume that if an oil company teaches young people in its host community skills for managing the ROW of a pipeline, it will benefit in the long term from proper pipeline management.

Frynas (2005) analysed the natural resource-based view of companies and the dynamics of their approach to corporate social responsibility initiatives, concluding that multinational corporations are in the habit of promising environmentally responsible development to host communities, but do not keep these promises. By contrast, this view maintains that for a firm to do better competitively, it has to combine the unique interplay of human, organisational and environmental factors in time (Dyllick *et al.*, 2002). The proponents of this approach contend that the essence of business derives from the creation and recombination of resources into new

sources of competitive advantage (Branco and Rodrigues, 2006). In this regard, corporate social responsibility is a matter of organisational and strategic routines, by which resources are acquired, modified, integrated and, in some cases, recombined to generate new values to give a business and its products a competitive advantage (McWilliams and Siegel, 2001). Based on this perspective, some authors have identified social and ethical resources cultivated through social corporate responsibility outreach as having the capability to advance the competitive advantage of an organisation.

The focus of this earlier group of theorists is economic development that falls within the corporate mission of the organisation (Heal, 2005). Their contention is that every development is valuable in as much as it is a development, irrespective of the consequences that the environment and the social fabric of society may suffer.

2.3.3 Political theorists and corporate constitutionalism

The political theorists of corporate social responsibility focus on the interactions and inherent connections between corporate organisations and the society in which they operate and on the power and position of the business and its inherent responsibility to its shareholders and other stakeholders (Matten and Crane, 2003). Political theorists broadly recognise two sub-themes in their explanation of the doctrine of corporate social responsibility. These are the doctrines of corporate constitutionalism and of corporate citizenship.

Corporate constitutionalism, according to Davis and Thompson (1994), explores the role of the power that business wields in society and the social impact of this power. They introduced to the long held view of instrumental theorists the notion of business as taking a more active role in corporation social responsibility. While recognising the obligation of business to pursue profit for shareholders, they argue that a business is a social institution with social power that must be used responsibly. In their contribution to the debate on corporate constitutionalism, Marquis *et al.* (2007) said that the causes that generate the social power of corporate organisations are not only internal to the organisation but also external, including the goodwill and social support of the society within which it operates.

However, the locus of corporate constitutionalism has been unstable and constantly shifting from the economic to the social standpoint; it also uses a political standpoint (Burke and Logsdon, 1996). In his argument for the role of business in influencing the political process, Davis (2005) formulated two principles that express how the social power that is acquired by a business over time through interaction with society should be managed. He stated them to be the "social power equation" and the "iron law of responsibility", explaining further that the social power equation has to do with the social responsibility of business which arises from the amount of social power attributable to the relationship they have cultivated with the host community over time. On the other hand, the iron law principle refers to the negative consequences of the absence of the use of the business's social power within the host community.

The contention is that in the absence of the use of social power, a vacuum is created. This vacuum, where it exists, could and has been exploited by the other powers that may not have the same stake in social stability that the business would (Husted and Allen, 2006). From the foregoing, it seems that effectuating corporate social responsibility does not only operate for the benefit of the host community, but the business also stands to gains from the calm orderliness it leaves in its trail. The business needs the society to be at peace so that it can thrive and the society needs the business to plough back part of its profit into the society so that some obvious developmental challenges can be met. This portrays a relationship between business and society that is symbiotic, and uses the instrument of corporate social responsibility as a platform.

In explaining the concept of corporate social responsibility within the context of corporate constitutionalism, Williams (2001) said that corporate organisations which fail to use the social power conferred on them by the place they occupy within the society, in a way that promotes mutual benefit for both the host communities and themselves, run the risk of losing their corporate position in society because other organisations will seek to fill the obvious vacuum and proceed to engender philanthropic activities that will create and maintain a place for them within the social fabric. This is because businesses irrefutably owe their existence to societal patronage and so should promote activities that allow them to remain connected.

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Davis (2005) contended that the equation of social power and responsibility has to be understood through the functional role of the business organisation and the inclination of business managers to commit organisations to conduct business in a way that benefits both shareholders and other stakeholders. Davis further stated that limits to corporate organisations' functional power within society are imposed by pressures from different groups within host communities. When this happens, businesses are sensitised to their moral obligations to the host communities, to which they owe not only their operational profitability but also their very existence - since they could not have existed in a vacuum. In his explanation of the political framework for corporate social responsibility, Davis (2005) stated that organisational power and wealth should find a way through the medium of corporate social responsibility to support and protect the interests of the majority of the larger stakeholders against the perceived inequity of the profiteering motives of businesses.

In arguing further that an increasing number of people, particularly civil society groups and more enlightened business managers, are becoming conscious of the need to better position business-society relations in a way that will make the business go beyond mere rhetoric in professing corporate social responsibility, Birch (2003) stated that:

> *[...]the debates around business-society relations, as they have developed in the last few years, disparate and diverse though they may have been, are building a momentum now, which sees discussion in this area worldwide, rapidly forming a consensus that business, and its reliance on an old economics which has marginalised social, environmental and cultural capital, must change. This momentum is increasingly reflected in the many demands being placed upon business to change performance, reporting and compliance behaviours, policies and practices, in order to become a more public and socially responsible enterprise. (Birch, 2003: page 9).*

From this statement it is clear that corporate social responsibility connotes the totality of the social contract the business should have with the society in which it conducts its business, either directly or remotely. Furthermore, it shows the need for the inherent social connection between the business and the society to reflect in the corporate attitude of the business. This perspective is consistent with view of Lantos (2001), who stated that business should not create a scenario of neighbourhood poverty and affluence co-locating side by side in the same community. He argued further that if businesses fail to create the social capital that will promote equity and

justice in their engagement with host communities, social tension is bound to be created and this, if accumulated over time, has the prospect of impairing the tranquillity the business needs to further its shareholder's interest in profits.

Similarly, Frynas (2005) has explained that multinational companies, especially those involved in oil and gas exploration activities, propagate corporate social responsibility as a matter of public relations campaigning, with no intention or accompanying action plan to translate their avowed promises of development into reality in their host communities. The oil and gas sector has been among the leading advocates of Corporate Social Responsibility globally (Frynas, 2005; Valor, 2005). As a means of portraying their activities in an environmentally friendly manner, oil and gas companies now attach more importance to the social, economic and environmental impacts on the communities that host their operations. These impacts, which range from marked changes in community means of subsistence and transformation of community ways of life, to destruction of community environment and amenities, have become a source of various actions by rights groups and environmentalists around the world (Frynas, 2005).

A range of negative impacts have been reputedly caused by operations of companies, especially the oil and gas sectors, around the world (Jenkins and Yakovleva, 2006). As a result, many host communities and their tenant oil companies are reportedly said to living be in two different worlds socially and economically, even though they exist side by side in the same geographical vicinity (McAdam and Leonard, 2003). The substance and effectiveness of corporate social responsibility initiatives in this scenario has been questioned as not meeting the objective of transposing the avowed developmental goodwill of the companies into tangible improvements in the material conditions of the communities (Frynas, 2005).

2.3.4 Corporate citizenship

Donaldson and Dunfee (1994) argued for the corporate social responsibility of businesses to their host communities from the perspective of integrative social contract theory. They considered the business-society relationship from the perspective of the social contract, assuming the existence of an implicit social contract between the business and the society within which it operates. The social

contract implies an indirect social obligation by business concerns to their host communities.

This approach to corporate social responsibility has the advantage of businesses being viewed as part of the business from the outset and so the difficulty of having to appropriate part of the company profits for corporate social responsibility activities within the host communities would not arise (Moir, 2001). Furthermore, this integrative approach has the advantage of sensitising the business towards its social contract with society. In so doing, the environmental and social concerns of employees and of other stakeholders are continuously addressed in an equitable manner.

Although the idea of the corporation as citizen is not new, the term corporate citizenship became commonly used by practitioners in the 1990s to describe corporate organisations that engage in corporate philanthropy in fulfilment of their social responsibility to host communities (Davenport, 2000). The idea works from the premise that the corporation is accountable not only to its shareholders but to its other stakeholders. In this regard, corporations are recognised as corporate citizens; hence, they must have a stake in the development of the immediate environment (McWilliams *et al.*, 2006). A renewed interest in the use of the term among practitioners has become more prominent in the last decade, due to the greater awareness that businesses in the community should have a commitment to the latter's developmental aspirations (McWilliams *et al.*, 2006).

Certain factors in past decades have given rise to the term coming into popular use to describe the impact of the business-society relationship on the achievement of development in the host community. According to Vogel (2005), worthy of note among the factors that have promoted the popular use of "corporate citizenship" are the crisis of the welfare state and the challenges of the globalisation phenomenon. These factors, together with the expansion of capitalism in the wake of the industrial revolution and decreasing costs owing to technological improvements, have increased the profitability of certain of the large corporations, resulting in a level of economic and social power which has made them equivalent in strength to some governments.

As mentioned earlier, in the past two decades, the term corporate citizenship gained popularity as a term used by practitioners to describe the relationship that should exist between business and the society in which it operates (Garriga and Melé, 2004). Corporate citizenship as a variant of corporate social responsibility connotes a sense of the way in which a business might belong to the community. Furthermore, Husted and Allen (2006) have said that it is increasingly becoming clear that corporate organisations need to take the community in which they operate into account, so that as their profits grow, they also contribute positively to the community in order to promote mutuality of interest and reduce social tension and acrimony that lack and poverty could cause between the community and the business that operates within it.

The term corporate citizenship is variously interpreted by different scholars (Mohanty, 2007). In this regard, Moon *et al.* (2005) identified three distinct views of the meaning of corporate citizenship. One of the views sees the concept from the limited viewpoint of corporate philanthropy. The second view sees corporate citizenship as a synonym of corporate social responsibility. The proponents of this viewpoint contend that corporate citizenship is all that corporate social responsibility embodies, while the third viewpoint conceives of corporate citizenship as being wider than corporate social responsibility in scope (Mohanty, 2007; Moon *et al.*, 2005). From the three views above, corporate citizenship seems to represent a new conceptualisation of the role of business in the society and connotes the changing paradigm of social corporate responsibility.

In spite of the different viewpoints on the corporate citizenship paradigm of corporate social responsibility (Bondy, 2008), there is consensus between most scholars on some points: mainly, they agree on the notion of the strong sense of social responsibility by business towards the local community, partnerships between the business and the host community which imply a specific way of formalising the commitment to improve the local community, and the consensus that business practices should be informed by principles of environmental equity and justice. Indeed, due to intense protests against the negative footprints that have characterised the activities of multinational corporations around the world, the concern for the environmental consequences of businesses in host communities has progressively gained momentum over past decades (Werther Jr and Chandler, 2010).

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2.3.5 The integrative social contract approach

According to Moir (2001), the integrative approach looks at how business integrates social and environmental demands and concerns into its activities. It is argued from this position that business depends on society for its very existence, growth and continuity. Social demands are generally regarded as a way in which the society interacts with business in order to give it moral legitimacy and prestige (Knox and Maklan, 2004; Maignan and Ferrell, 2004). This approach presupposes that corporate organisations have to take into account, social and environmental considerations and integrate them in such a way that the business operates in accordance with social values, leaving minimum impact on the environment. In this context, the content of corporate social responsibility is dependent on the changing values of the society over time and within a given political space.

The proponents of this approach contend that the business must respond to the social and environmental demands of their host communities and other non-shareholder stakeholders in order to achieve the greater social legitimacy and acceptance necessary for the stable environment required for business growth and development (Swanson, 1999). This approach is inclined to favour the integration of the relevant concerns of other stakeholders beyond the shareholders into the operational exigencies of the business. Integrative theorists place great importance on the way in which business may make a difference to the environment in which people live and work, by fostering and maintaining relationships with communities, being a good neighbour and contributing to sustainable development initiatives (Schwartz and Carroll, 2003).

Schwartz and Carroll (2003) analysed the relevant issues regarding the integration mechanisms an organisation must have in order to sensitise its corporate mission to the social and environmental challenges of its activities within the host community. They argue that social and environmental considerations should spread and be integrated across the organisation through a mechanism they termed "institutionalisation", meaning these concerns should be imbibed as part of the ethical principles of the business so that implementing them will be devoid of administrative bureaucracy, emphasizing a recognised process in addition to the appropriate principles laid down as part of the mission statement of the organisation.

Knox and Maklan (2004) explore the integrative approach to corporate social responsibility from the point of view of the political process. Corporate social responsibility from the perspective of the integrative approach underpins a fair process where all interests have the opportunity of being heard. Knox and Maklan (2004) emphasise inputs into the decision making process by all stakeholders, as against the tradition of mainly focusing on outcomes. By so doing, the implementation process and activities may be expected to capture the aspirations of the majority of the stakeholders, going beyond the goals of the immediate shareholders of the business, whose interest is profit maximisation and greater return on investment.

The concept of social responsiveness of business within the community as a way of achieving the doctrine of corporate social responsibility has expanded in the past two decades because of the demand that businesses shift their corporate social responsibility strategy from reactionary to careful planning, making it part of organisational management activities. This way, businesses have corporate social responsibility provided for in their long term organisational development planning (Knox and Maklan, 2004). This includes the integration mechanism canvassed by Schwartz and Carroll (2003) but also emphasises the process for making a reasoned response to the social issues generated by the activities of a business within its host community.

The incorporation of management issues in relation to corporate social responsibility has been propounded by Waddock and Graves (1997) as a way of influencing corporate organisations' strategies, and involves the process by which corporations can identify, evaluate and respond to social, political and environmental issues which could impact on them significantly if left to chance. These authors further explained that incorporating corporate social responsibility into the central management framework of the corporation is an attempt to minimise the risk of substantial levels of social tension being allowed to build up before they are brought to the attention of managers. In this regard, corporate social responsibility is an early warning system for potential environmental threats and opportunities. Furthermore, this approach to corporate social responsibility prompts more systematic and effective response to issues that perturb organisational interests by serving as an integrating and coordinating mechanism for engagement with the host community.

2.3.6 The public responsibility approach

Garriga and Melé (2004) tried to use the public responsibility approach to provide an explanation of the remit of corporate social responsibility. They criticised the purely issue-based response approach as being reactionary and lacking reflection of the scope of the corporation's moral duty to the public. By choosing the term "public" rather than "social", they stressed the importance of the public process, as against what they termed narrow interest groups defining the scope of responsibility for corporate organisations. Jamali (2007) also argued that the appropriate approach to corporate social responsibility is to detail a prescription of appropriate guidelines for businesses to align their management activities to relevant public policy frameworks that will enable them to gain moral legitimacy in their host community.

Garriga and Melé (2004) stated further that the public responsibility approach also differentiates between primary and secondary involvement in the discharge of corporate social responsibilities in host communities. Primary involvement in this regard has to do with the alignment of company operational activities in such a way that they give the members of the host communities access to employment and procurement opportunities within the company. On the other hand, secondary involvement, which comes as a consequence of primary involvement, relates to the direct involvement of the business in the execution of tangible developmental activities within communities. It stems from active engagement of business in funding the social and physical infrastructural development of host communities. It is, however, impracticable to attempt to determine the exact content of what constitutes public responsibility.

From the explanation above, the general idea behind the public responsibility approach to corporate social responsibility is to frame a set of expectations for business to try to attain. This way, corporate organisations can be seen to be constantly striving to improve in their drive to make returns to the community where they conduct their business.

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2.3.7 Stakeholder management

Stakeholder management is oriented towards those people in the communities affected by the corporate and operational practices of the business (Clarkson, 1995). Academic development of the debate around stakeholder management as an approach to corporate social responsibility is fairly recent, starting only towards the last quarter of the 20th century (Orlitzky *et al.*, 2003; Wood, 1991). Two basic principles underpin the stakeholder management approach (Wood and Jones, 1993). The central goal of the first principle is the achievement of sustainable overall cooperation across the entire system of stakeholder groups in the business. The idea is to achieve a balance between the profit motives of the shareholder stakeholders and the social contract expectations of the non-shareholder stakeholders. The second principle involves a vision of simultaneously dealing with issues affecting all stakeholders as they arise in equitable ways and ensuring that shareholder and non-shareholder interest is reflected in the corporate social responsibility initiatives of the business.

The stakeholder management approach rests in the integration of the interests of stakeholder groups into the mainstream decision making processes of the organisation. The utility of this approach lies in applying it to determine best practices in corporate stakeholder management. Scholars in the first decade of the 21th century, according to Hillman and Keim (2001), have looked at different aspects of the impacts of stakeholder management on the profitability of the business and returns on investment for shareholders. According to them, this has included research into various aspects of shareholder networks on the structural aspects of company policies concerning the extent of business involvement in corporate social activities within the community. Other proponents of the stakeholder management approach have also looked at the effects of balancing two competing demands: those of various stakeholder groups on the social contract between the business and the host community; and communities' reactions to changes in the attitudes of businesses to social investments in the society. It is submitted in this regard that giving host community members the status of stakeholders creates a foundation for building a symbiotic social relationship that will further the corporate social performance of the business in the host community (Garriga and Melé, 2004).

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2.3.8 Corporate social performance

The corporate social performance approach is a hybrid concept that attempts to integrate other approaches to corporate social responsibility (McWilliams *et al.*, 2006). It involves the search for moral legitimacy in the social processes by which businesses engage communities in pursuance of corporate social responsibility objectives. Carroll (1991) developed a model of corporate social performance which listed issues where a responsibility exists and specified that a philosophical response should be adopted in dealing with the social issues associated with the relationship between business and the host community. She explained that the scope of social responsibility should cover a range of obligations that business has to its host community. This, according to her, should embody economic, legal, ethical and other discretionary areas of engagement of the business in the community.

Similarly, Wartick and Cochran (1985) introduced the principles of social responsibility, insisting that the essence of corporate social responsibility is predicated on the process of the social responsiveness of the business to the needs of the communities, and that this provides the social capital for its profitability in terms of both labour supply and patronage. A new approach was, however, introduced by Orlitzky (2001), who outlined a model of social performance consisting of the principles of corporate social responsibility emphasised by Wartick and Cochran (1985). These principles have now been understood as capable of being exploited by businesses to achieve their corporate operational values (Doh and Guay, 2006). These values are expressed variously at organisational and individual levels, as processes of corporate social responsiveness in the areas of: environmental assessment; stakeholder management; and the outcomes of corporate operational behaviour which generate social impacts; as well as social programmes and social policies aimed at promoting the mutual interests of businesses within the remit of acceptable limits within the host communities' ethical and legal environments. Achieving corporate compliance on the operational policies of businesses in terms of the diligent observance of the applicable ethical, legal and social frameworks of host communities is a moral task that many businesses have been unable to succeed in (Weaver *et al.*, 1999).

2.3.9 Ethical approach to corporate social responsibility

Another approach to corporate social responsibility according to Weaver *et al.* (1999) focuses on the ethical requirements that should form the basis of the interactions between the business and the host community. The ethical approach is based on the principle of the need to do the right thing in order to achieve a fair and just society. This approach to corporate social responsibility is normative and based on stakeholder management, which seeks to integrate the social demands of relevant stakeholders in the conceptualisation and management of social engagement with the host community (Garriga and Melé, 2004).

Stakeholder management has become an ethically-based principle for approaching issues of corporate social responsibility, and it became popular after 1984 following the publication of the book "Strategic Management: A Stakeholder Approach" by Freeman (Garriga and Melé, 2004). In this book he highlighted the fiduciary relationship which imposes rights and obligations on all stakeholders (Harrison and Freeman, 1999). He defined stakeholders as those who have a stake in the company and listed them to include, but not be limited to, suppliers, customers, employees, shareholders and the local community.

Following this approach, therefore, a socially responsible business, in fulfilment of its fiduciary duties to stakeholders, is required to simultaneously attend to the legitimate interests of all stakeholders. This it must do equitably, giving effect to the legitimate demands of the weak and vulnerable as well as the aspirations of the strong and mighty among the stakeholder pool (Freeman and Velamuri, 2008). In order to construe how corporations should be governed and how managers act when they have overarching responsibility for managing the fiduciary social contract with other stakeholders, a normative element of ethical principles is required (Freeman and Velamuri, 2008). As a result, different stakeholders have proposed differing elements of the normative principle, including the Rawlsian and the Kantian principles (Freeman and Velamuri, 2008). The Rawlsian principle is based on equity and fair-play on the part of the company in dispensing its corporate social responsibility patronage as opposed to the Kantian prescription that corporate social responsibility is a sort of corporate philanthropy.

2.3.10 Strategic corporate social responsibility

Based on the realisation that promoting societal welfare does not preclude the systematic pursuit of strategic business interests (Fox, 2004), organisations now imply the integration of philanthropy into the corporate strategic management process. In practice, this translates into a systematic effort at professionalising the function of the contributions that business makes to society (Fox, 2004) Organisations do this by applying the contributions of company resources to the strategic areas of host community needs, alongside organisational goals, evolving a set of guidelines for resource allocation, as well as criteria for quantifying the impacts of social investments in the community. The underlying appeal of this philanthropy-styled approach lies in its reconciliation of societal interests and bottom-line performance, a consideration that developing country businesses can certainly take advantage of.

Embarking on a strategic corporate social responsibility programme (Lantos, 2001) is a major commitment by the business to the community where it operates. It requires changes in the way responsibility management has traditionally been approached between businesses and their host communities, so that equity and environmental justice would prevail in the relationship between the business and the host community (Lantos, 2001). It should not be taken lightly, nor conceived as something separate from the business. Rather, it implies a new way of doing business, coupled with the judicious deployment of existing knowledge and processes to accommodate new expectations of the business sector within the remit of environmental justice and equity (McWilliams *et al.*, 2006). It calls for a fundamental re-orientation to social responsibility management on the part of the business. The benefits of such strategic repositioning are likely to outweigh the costs, allowing in turn the nurturing and preservation of philanthropy as the oldest form of corporate social behaviour (McWilliams and Siegel, 2000). As a result, many companies now adopt a strategic policy of donating to various causes in their host communities, as a way of improving their social relationship with their host communities.

2.4 Sustainable development

Many definitions of sustainable development have been proposed (Brandon and Lombardi, 2010a; Westing, 1996). However, a content analysis of the numerous definitions so far, according to Brandon and Lombardi, (2010b), suggest that sustainable development is a process of achieving human development in a manner that is inclusive, equitable, prudent and integrative. Therefore, sustainable development is an ideal towards which society's business and host communities should continually strive, through a detailed programme of collaborative planning to create values and outcomes that are consistent with the ideals of sustainability, including its "social, environmental and economic considerations" as these are part of sustainable development.

The approach has as its driving principle the objective of supporting companies to observe environmental, economic, social, and political justice in the communities where they do business (Weissbrodt and Kruger, 2003; Clark *et al.*, 1998). The universal rights principle is based on the Declaration of Human Rights and other international declarations on human rights, labour rights and environmental protection, all of which were adopted by the United Nations in 1984 (Weissbrodt and Kruger, 2003). The implementation of these conventions towards the goal of achieving corporate social responsibility by businesses in their host communities has been based on consensus rather than enforcement, and this has led to the proposition by many scholars that universal rights are mere declarations which need not be enforced on businesses, especially multinational ones.

The oil and gas sector has been among the leading advocates of Corporate Social Responsibility globally (Frynas, 2005). Oil and gas companies now attach importance to the social, economic and environmental impacts of their operations in host communities. These impacts range from marked changes in community means of subsistence, transformation of community ways of life to destruction of community environment and amenity. Sustainable development-related environmental impacts have been reputed to be associated with the operations of companies in the oil and gas sector around the world (Jenkins and Yakovleva, 2006).

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The substance and effectiveness of corporate social responsibility initiatives have been questioned (Frynas, 2005). The question of the imperative of corporate social responsibility in the Nigerian oil and gas sector has often alluded to the fact that that there is discord between the oil and gas companies and the communities in which they conduct their businesses (Warhurst, 2005). Analyses of the place of corporate social responsibility in the business and operational policy thrust of oil companies active in Nigeria will identify this discord, leading to a synthesis from which appropriate policy recommendations will be made, synchronising data from all stakeholders in order to facilitate a mutually beneficial overall relationship between host communities and the companies. This relationship will seek to balance the environmental externalities of their operations against the presumptions of sustainability considerations, as the business should relate to the environment on the one hand, and execute its fiduciary duty to the community on the other (Newell and Frynas, 2007; Rondinelli and Berry, 2000; World Commission on Environment and Development, 1987).

Sustainable development is another value-based principle which became popular after the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, 3-14 June 1992 (Friedman *et al.*, 2005). The term came into widespread use in 1987 when the World Commission on the Environment and Development published its report titled "Our Common Future" (World Commission on Environment and Development, 1987). The report, which is also called the "Brundtland Report", after its Norwegian chairwoman, stated that sustainable development seeks to meet the needs of the present without compromising the ability of the environment to meet the needs of the future generation.

Although the Brundtland report (World Commission on Environment and Development, 1987) was originally intended to highlight issues of the environment and sustainability (Blowfield, 2005; Pianta, 2005), its scope has since expanded to include considerations of social dimensions as being inseparable from business and development. Sustainable development requires the integration of social, environmental and economic considerations into business and other developmental processes that impact on the totality of the environment in order to achieve environmental justice, equity and balanced judgments for long term sustainability (United Nations, 2000). As a result, sustainable development gained universal

acceptance as the preferred way companies should relate to their environment as they conduct their business in communities around the world.

2.4.1 Sustainability in linear infrastructure management

Physical development and the management of linear infrastructure is a major source of negative environmental impacts around the world (Pender *et al.*, 2004). The concept of sustainable development, which connotes economic and social development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs, could be applied to the environmental and other challenges associated with the development and management of linear infrastructure (Rotmans *et al.*, 2001). As Onokerhoraye (1995) stated, the concept of sustainable development has emerged as the central and unifying theme of a new environmental agenda for public policy. This, he opined, lends itself to dealing with the negative environmental externalities of physical and infrastructural development projects. At the global level, the level of awareness was high, but efforts aimed at addressing the problem were slow. This came to global attention at the Earth Summit in 1984 (World Commission on Environment and Development, 1987) by the United Nations, and subsequent implementation of the concept has also been at a slow pace, as scholars have agreed (Jaeger *et al.*, 2008; Colby, 1991) through its agencies such as the United Nations Environmental Programme and the United Nations Development Programme. These agencies of the United Nations succeeded in popularising the concept in the 1990s, giving rise to various national interventions and initiatives aimed at minimising the negative externalities of physical development activities globally (Bruno and Karliner, 2002; Schmidheiny and Zorraquin, 1998).

The sustainable development agenda recognised the intricate relationship between social, economic and environmental policy permutations, which are influenced by physical developmental project initiatives aimed at achieving national development agendas aligned with the global environmental sustainability goals at the heart of civil society campaigning and the objectives of the United Nations and its agencies (Adegoroye, 2006; Hopwood *et al.*, 2005).

The sustainable development agenda is aimed at physical development activity in its entirety and prescribes that development must be socially desirable and fulfil the

needs of the people - culturally, materially and spiritually - in equitable ways. This aims to achieve developmental strides that are economically viable and which pay for themselves, with the costs not exceeding the benefits (Nijkamp and Soeteman, 1993). The concept also introduced the doctrine of ecological sustainability into the development arena, canvassing the long term viability of the supporting ecosystem and building environmental sustainability initiatives into infrastructural development projects (Uyanga *et al.*, 2005).

Measured against the three tenets of sustainable development explained above, infrastructural development projects, which started with the industrial revolution decades before the concept of sustainable development became popular in the physical development arena, is still, in the 21st century far, from meeting the goals of sustainable development (Brundtland, 1987). The non-commitment of the current infrastructural development strategy to integrate environmental sustainability initiatives into the development agenda has impacted negatively on the ecological sustainability of ROW and caused a marked degradation of the environmental and social quality of life in the communities located close to major infrastructural development projects (Kirkby *et al.*, 1996).

2.4.2 Environmental sustainability in communities

The negative externalities of major development projects and the plethora of associated disasters recorded in the last decade have destroyed the social fabric of many communities, especially in areas where oil and gas exploration takes place (Frynas, 2005). The destruction of the agrarian economic assets of communities, such as arable lands and fish ponds, have foisted economic desperation on people with some of them reportedly taking to anti-social behavioural activities such as hooliganism, drunkenness and vandalism (Onuoha, 2008e). The complete absence of social infrastructure, even schools, in communities that play host to major extractive industrial activities over a long period of time has led to children growing into adulthood without any formal education (Middleton and O'Keefe, 2003; Vivian, 1994). As a result, around the world there exist generations of people who can easily be swayed into activities that impact negatively on the environment.

The primary economic assets of communities have been greatly compromised by their infrastructural development projects (Langhelle, 1999). The arable lands and

fish ponds on which many agrarian communities' internal economies are based have been contaminated by the effects of infrastructural development-induced disasters, which have become a regular occurrence globally. This has deprived people of access to productive economic activities and also left them with no alternative means of productive economic engagement for meeting the challenges of daily economic sustenance, creating both poverty and human misery (O'Brien *et al.*, 2006).

In many communities, this group, many of whom have become brutalised by their conditions, form part of the ready army of recruits employed by vandal barons to damage petroleum pipelines and other infrastructures (Onuoha, 2007; Onokerhoraye, 1995). With a sense of hatred for public infrastructures, coupled with an inability to discern the criminality of actions which are against the law, this faction within indigenous communities around the world impugn the official indictments of vandalism and other activities inimical to the environment (Omotor, 2009). On the contrary, they accept offers from vandal barons to engage in the serial destruction of pipelines and other infrastructures conveying the derivatives of oil through their various settlements, enabling the barons to profit from the stolen derivatives and sabotage efforts to achieve the goals of the Earth Summit (Bruno and Karliner, 2002; Brundtland, 1987).

The global plan of action on sustainable development, called Agenda 21, has advanced a set of programme areas which range from trade-offs on developmental programmes based on environmental considerations, through to agricultural and desertification issues, to questions of capacity building and appropriate technology transfer from developed to developing countries, for the purpose of coping with the challenges of aligning developmental activities for the achievement of the goals of sustainable development (Dernbach, 1998; Sitarz, 1993). Application of the principles that underpin Agenda 21 to the activities in and around infrastructural development projects would reveal their overarching environmental sustainability implications.

Health facilities are rarely available in the host communities of major extractive industries, in spite of community exposure to the negative consequences of frequent infrastructural vandalism to installations, infernos and other environmental degradations which so frequently besets these vulnerable communities around the

world (Ikelegbe, 2005b). The people in these communities accuse their governments and the multinational extractive companies of official ineptitude with regard to the management of the ROW and other lands acquired. Members of these communities feel frustrated by the appropriation of wealth derived from oil and other mining activities, and this is one of the driving propensities behind the covert support that these acts of vandalism seem to receive from the multitude of uneducated youths in these communities (Onuoha, 2008c; Ogri, 2001). Moreover, because of the frequent oil spill and other environmental problems that pervade these communities, disease infestations are common (Birley, 2005). Those born to these communities are faced with peculiar environmental and socio-economic challenges, in terms of healthcare and environmental sustainability, from childhood (Birley, 2005; Ebigbo, 2003; Sitarz, 1993).

2.4.3 Agenda 21 and infrastructure management

Sustainability, as postulated by Agenda 21, rests on three pillars: social, economic and environmental sustainability. Contrary to the growing implementation of these triple tenets of sustainability as enunciated above, many corporate activities impact on communities and their inhabitants have witnessed deterioration across the three sustainability dimensions. Environmentally, the communities have experienced pollution caused by oil spill. Vast areas of forest assets have been lost around the world due to fires that resulted from the numerous oil spills that occurred in the past decade, resulting in many knock-on environmental disasters and causing poverty (O'Brien *et al.*, 2008; Kates and Clark, 2000).

Furthermore, it is recognised that the reduction of disaster vulnerability is the core priority in disaster management, which is complemented by overarching recovery strategies. Careful planning, both in the nature and location of infrastructural development projects and the integration of strategies in preparedness for recovery, have been found to be the most effective measures in mitigating disasters that could result from the negative externalities of major developmental projects such as pipeline infrastructure (Doyle, 1998; Lafferty and Eckerberg, 1998). The pipeline projects in Nigeria and other oil producing countries in the developing world only underscore the concept of economic growth, in terms of revenue inflow to the government treasury coffers. However, this revenue could be used to provide for

fairness and economic improvement opportunities for the deprived communities that contend with the environmental failings of the pipeline project (Onuoha, 2008e).

Agenda 21 anticipates that infrastructural development projects like oil pipelines offer unique opportunities for supplying the necessary resources for building sustainable environmental infrastructure to protect the carrying capacity of the natural environment (Doyle, 1998; Lafferty and Eckerberg, 1998). It also recognises the overall aim of major infrastructural development projects as being the achievement of overall development in the communities within their catchment areas, including the improvement of the social, economic and environmental quality of the living and working environment (Folke *et al.*, 2002)

There has been social deprivation in many communities around the world because the commodity, that is transported through pipelines and other linear infrastructures that traverse their land, is inaccessible to them (Schipper and Pelling, 2006). Studies show that these communities lack healthcare facilities and schools. Economically, the members of these communities live on less than one American dollar a day (World Bank, 2004). The primary economic assets of community members, which consist of arable land and fish ponds, have been affected by pipelines and other infrastructural development projects and the frequent spillage of oil owing to vandalism along the ROW (Onuoha, 2008a; Clark and Dickson, 2003; Du Plessis, 2002). Efforts to meet the needs of a growing population of impoverished people interconnected by linear infrastructures and their associated ROW, have not proceeded beyond rhetoric, even on occasions when major oil spillages have prompted sympathy visits to the communities (Onuoha, 2007; Schipper and Pelling, 2006). This inequitable handling of the growing social, economic and environmental challenges caused by the introduction of the pipelines and other linear infrastructures is undermining the essential natural life-support systems in the affected communities (Onuoha, 2007).

People in these communities who have been impoverished by infrastructural development projects are forced by the inability of the state to resettle them away from the hazard-prone areas to continue occupy sites that have become environmentally unsafe (Onuoha, 2007). Major infrastructural development projects have adverse effects on personal well-being of those in the communities near which

they are located (Onuoha, 2007). Added to the problem of well-being is the outcome of acts of vandalism, which have been known to contaminate the natural environment. According to Bryant (1998), it is widely accepted that social equity, social integration, social justice and social stability are of fundamental importance in mobilising people for the implementation of Agenda 21 within any local community. Absence of these driving elements of social mobilisation weakens the prospects for achieving environmental sustainability in the way the community members interact with their natural environment (Rakodi *et al.*, 2002; Cline-Cole, 1996; Dalal-Clayton, 1993).

The issue of welfare in society is closely related to social and economic development, both of which should enable a just and equitable distribution of opportunities for people in any egalitarian society. However, unless there is peace and social stability, economic development can be stifled at source or even destroyed before it achieves the status of sustainability. Sustainable development involves avoiding social exclusion, increasing democracy and increasing transparency in the way the government relates with the governed. As against the situation across the ROW communities in Nigeria, the salient social issues include support for the informal sector in communities; valuing the employable generation as social capital, along with the attendant economic emancipation for employees; encouraging the functioning of neighbourhood social infrastructure systems and supporting the very poorest in the community to prevent desperation, which may cause them to drift into involvement in social vices (El-Masri and Tipple, 2002; Bryant, 1998).

In their examination of the application of sustainable development principles to natural disaster mitigation in developing countries, El-Masri and Tipple (2002) identified three interrelated aspects in addressing the problem of disaster mitigation and sustainability: land-use planning and policies; shelter design, building materials and construction methods; and institutional organisation at local, provincial, national and international levels. They illustrated these three aspects on the basis of experiences of human settlements in specific disaster situations and of housing the poor in developing countries in general. However, they did not relate the problem to civil and other ancillary works associated with the displacement of earth and other post-construction activities related to project pipeline development. They stressed the need for taking into consideration the scale of the problem and the variety of

conditions associated with any given project, in order to identify the most pressing issues that will inform formulation-specific remedies and policy intervention measures aimed at making the project sustainable.

Mitchell (1996) noted that procedures that advance environmental sustainability must entail transferring its core ideas into implementation strategies, in which creative combinations of solutions, priorities, timeframes and resources are identified. He contended that the overall success or otherwise of a development project within the context of sustainable development will depend on the nature of the activities that created the particular disaster situation, which requires a detailed understanding of the circumstances of a particular project type and the kind of disaster that could result from it. For instance, major irrigation dam projects are likely to cause flood related-disasters; and pipelines projects are likely to cause soil contamination and oil spillage if the pipelines fail owing to natural decay or vandalism. Adjustments and changes have been proposed which could be applied to housing-related human settlement type disasters. The proposal was construed in terms of the shape and growth pattern of the settlement: and it has been suggested that, if managed within the remit of Agenda 21, this would ensure harmonious interactions between natural and human systems, so that vulnerability to natural disasters would be minimised (Tipple, 2006; Mitchell, 1996).

The achievement of sustainable development as construed by Agenda 21 involves the efforts of the citizenry in the context of a city, neighbourhood or a region. This indicates that the democratic involvement of the people is a precondition to achieving sustainable development. It also implies that people should be involved in the planning and implementation of improvement strategies that affect their everyday lives, creating responsibilities for every stakeholder to ensure that such improvements are maintained and operated within a guideline that promotes inclusivity. As against a ROW management policy that is based on a top-down, governmental authority approach, based on stringent statutory provisions that exclude communities in terms of the apportionment of roles, sustainable development requires that decisions are taken at the lowest possible level of administration (Tipple, 2006; Majale, 2001).

2.4.4 Infrastructural development and communities

Disaster is the interaction between a hazardous situation, which may be natural or man-made, and vulnerable conditions which result in severe loss to humans and their environment (Tipple, 2006; Glickman, 1993; Dyregrov, 1989). These losses create suffering and chaos that affect the normal pattern of life, leading to social, economic and sometimes cultural and political disruption. Disaster situations require the attention and collaboration of stakeholders from within and outside the affected community (Westendorff, 2009).

Natural disasters inflict huge human and economic losses world-wide (Coudouel *et al.*, 2002; Hodgkinson and Stewart, 1991). During the 1970s, 1980s and 1990s, they cost the lives of over five million people and adversely affected the livelihoods of over one billion more people. In the first decade of the 21st century, both natural and man-made disasters have caused economic losses in excess of $100 billion (Williams, 2010; Austin, 2006). In Nigeria, while the human and environmental losses caused by petroleum pipeline disasters have not been quantified, the economical loss has been estimated at $1.5 billion (Nwankwo and Ezeobi, 2008). Social, economic and environmental damage and death caused by disasters have increased in developing countries: over 96% of disaster-related deaths occur amongst the two-thirds of the world's population which occupies developing countries (Tipple, 2006; Pearce, 2003). Disaster management and recovery operations have been better coordinated through multi-stakeholder collaboration approaches (Kulyapin *et al.*, 1990).

Collaboration among relevant stakeholders is integral for managing a disaster situation (Cruz *et al.*, 2006). As Kulyapin *et al.* (1990) reported, the pipeline explosion of June 1989 that destroyed two passenger trains in the Bashkiria Republic of the then Soviet Union illustrates how inter-stakeholder collaboration could foster a process of disaster crisis management that was not only effective but also ensured that the kinds of antibiotics appropriate for the resulting infections were made available. The disaster involved the destruction of two passenger trains by gaseous substances that escaped from an exploded pipeline. It resulted in the deaths of over 400 passengers, with another 806 persons injured. The disaster management initiative, which involved a combined Soviet and United States team, was

complemented by other stakeholders. Because of the collaborative approach employed, within hours to a few days of the disaster occurring, 26 patients underwent excision and grafting of their burn wounds. Microbiological studies indicated significant resistance to locally-available antibiotics but antibiotics provided by the US team proved useful in treating the resistant organisms. This disaster, and the international response to it, exemplifies the need for a coordinated response to major burn disasters and the positive results of international cooperation (Kulyapin *et al.*, 1990). The collaboration also achieved rapid post trauma recovery for the local community from the shock and socio-economic losses from the chemical pipeline explosion.

Poverty has constrained people to continue to live close to the sites of major infrastructural facilities because of proximity to their work place (Agbazie, 2004). Communities continue to occupy settlements that are not only marginally close to major industrial sites that lack meaningful planning, but are also increasingly becoming dangerous for human habitation because of the negative environmental and other effects of their neighbouring industries. In these circumstances, neither settlement growth nor the housing units themselves are designed to mitigate the impacts of disasters in pipeline communities, and these disasters have become increasingly common due to the negative externalities of the industries, which are mostly extractive. As has been the case with most disasters (Beggs *et al.*, 1996), the reactionary donation of aid and disaster relief to communities has usually been reported to be insignificant compared to the overall volume of losses that is repeatedly generated by incessant cases of preventable vandalism in disaster-prone regions of the world (Ugochukwu, 2008).

Success or failure of disaster mitigation planning depends on: a clear understanding of the land use and land ownership pattern within a community; a comprehensive understanding of land use policies and titles to land to address environmental quality; equitable management of natural resources, and poverty alleviation; careful consultation with the people concerned; adequate and incremental upgrading of infrastructure; and a collaborative framework that promotes the deeper understanding by all stakeholders of the interaction between the human and natural environment. A sound institutional framework for disaster mitigation requires

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cooperation across local, regional, national and international boundaries, in order to optimise the use of resources (Neville and Smythe, 2009).

Chapter 7 of Agenda 21provides a clear call for the agencies involved in the development process to re-align their remit from the traditional services-oriented concerns of local authorities, to the enablement and promotion of activities for inter-sectoral collaborative activity that recognises the role of all stakeholders, empowering the local population to take an active part in the developmental processes that affect their lives (Patton and Worthington, 1998).

As envisaged by the document, at the national level states are expected to provide adequate channels for building the local technical knowledge needed, and making development planning proposals that equitably respond to the real problems facing local people. The associated poverty and injustice in the appropriation of the commonwealth of the people, such as the issue of stewardship of Nigerian oil wealth, has been linked to the chains of activities that promote pipeline vandalism, which is the primary source of the environmental and socio-economic disasters associated with ROW communities in Nigeria.

2.5 The collaborative planning debate

The collaborative planning principle explores consensus-building and mediation as a way of moving beyond interest group conflicts, in resolving pre- and post-project environmental and socio-economic concerns (Healey, 1997c). The principle emphasises the potential for collaborative discussion of shared concerns about local environmental change, through which the affected community could learn about potential impacts and possible ways of evaluating and addressing identified project impacts, which could, in addition to its negative environmental externalities, have social and economic impacts on the people (Kovács and Paganelli, 2003; Healey, 1997c).

In the management of large scale infrastructural systems, according to Kovács and Paganelli (2003), provision should be made for a planning and management framework that engenders the collaboration of stakeholders across the infrastructure network for complex, distributed, multi-site, multi-enterprise organisations - particularly where there are large-scale engineering projects, characterised by huge

investments in both materials and human resources, which are likely to have environmental and socio-economic costs. They stated that a collaborative administrative vehicle will be required to provide an oversight function with respect to cumulative ecosystem impacts. Such an institutional framework would galvanise all the stakeholders along the ROW in Nigeria, with a view to forging a common ground for collaboration for the monitoring of the environmental and socio-economic problems caused by a particular project.

Building institutional capacity through collaborative approaches to planning has been found to have implications for improving the quality of places across a range of different types of environment (Healey, 1998a). This approach to planning practice has attracted increasing policy and academic interest in the United Kingdom and across contemporary Europe. This raises questions about the appropriate governance capacity to deliver improvements in the way environmental quality is managed. The key capacity of employing local cultural strengths in the ROW communities has not developed and become integrated: as a result, community members cannot readily mobilise themselves to capture opportunities and enhance local conditions to create opportunities across a geographic space that has been statutorily created through the ROW of linear infrastructures and their associated communities around the world. The communities in some cases have been institutionally and socio-economically fragmented. They lack connections to sources of power and knowledge, because they are not given the rightful status of stakeholder in the ROW that traverse their communities (Lowndes *et al.*, 2006; Fabricius and De Wet, 2002).

In contrast to the experience of the developing world, in the developed world collaborative partnerships for the management of public infrastructure such as pipelines have been discouraged by law (Neal, 2010; Kessides, 1997). In recent years, however, as the emphasis has been on attempts to change infrastructure management and urban governance capacity, particularly in Britain, there have been encouraging catalytic projects and partnerships between stakeholders (Healey, 1998a). As Healey (1998a) averred, recent experience across Europe suggests that wider transformative effects are difficult to achieve without careful consideration of the partnership form, and how it connects to the wider policy culture. As the wrong form or relationship to policy could equally have the effect of increasing local capacity fragmentation, prior examination of the potential of collaborative

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approaches in place-making initiatives may achieve more effective and durable transformations to achieve sustainability in public infrastructure management.

Collaborative Planning practice is hinged on engendering the participation of interested stakeholders in projects in which they share rights and obligations. These rights and obligations in any terrain-related project could be aggregated through the means of a geographic information system (Healey, 1998b). This entails the integration of spatial data into the collaborative design of a planning framework for monitoring activities over a given terrain (Allmendinger and Tewdwr-Jones, 2002; Eglene and Dawes, 1998; Goodchild, 1987). On the ROW of linear public infrastructures, governmental, corporate and non-governmental stakeholders proclaim different kinds of interests (Klein *et al.*, 2001). While on the one hand the government, through its different agencies, ascribes statutory interests to its actions on the ROW, and companies with commercial interests in ROW proclaim business and investment interests; on the other hand, the communities traversed by the ROW and other civil society organisations proclaim interests relating to environmental protection, and demand compensation for other negative externalities of the activities of the government and the companies in their immediate environment.

Stakeholder collaboration can be enabled through the agency of geographic information systems. This will ensure that for all the various stakeholders concerned in ROW, a consensus building avenue is built across the communities traversed by linear infrastructure (Barratt and Oliveira, 2001). Communities and institutions along the linear infrastructure corridor must act together to maximise resources - such as critical local knowledge in the communities; and technology -such as geographic information systems and finance - to achieve the sustainable management of linear infrastructure ROW within their communities. This will enable negative externalities to be contained before they assume the status of disasters (Obermeyer, 1998; Langran, 1992).

Non-governmental stakeholders, represented by communities and civil society groups, canvas safety, environmental and community socio-economic and cultural wellbeing in relation to the major infrastructural development-related disasters with which communities in the developing world are perennially faced (Norris *et al.*, 2008; Berkes *et al.*, 2007; Chang and Shinozuka, 2004). Collaborative planning has

been used as a common front for generating consensus from divergent and sometimes opposing views regarding the management of infrastructure that affects people in different ways (Doubleday, 2008; Scholz and Stiftel, 2005). Implementing collaborative actions is said to hold the potential to achieve real time environmental management.

Furthermore, it has been said that reducing the environmental impact of offshore operations is one of the most pressing challenges facing the oil and gas industry in Europe today (Huang et al., 2005; Salter and Ford, 2000). A study was conducted to review the issues through a search of the existing literature, and by consultation with stakeholders and experts in the oil and environmental management industry. The results of the research, according to Salter and Ford (2000), were dedicated to: protecting the marine environment; achieving compliance with existing legislative controls; assessing the technical and economic feasibility of platform disposal options; and ecological surveying. The research, however, reported that considerably less research had been carried out in other important areas, such as: assessing the impact of wastes returned to shore for disposal; identifying sustainable strategies for operations; and assessing and militating against adverse impacts from atmospheric emissions caused by oil industry operations.

The environmental regulatory regime for offshore operations in the United Kingdom and in Europe generally has become tougher and had an increasing influence on offshore oil and gas field environmental planning and management. Future proposals for environmental regulatory frameworks in the sector must therefore seek: the streamlining of the offshore oil and gas environmental regulatory regimes; the introduction of the Habitats Directive into the licensing system; and the implementation of the Offshore Combustion Installations as contemplated in the Prevention and Control of Pollution Regulations 1997 (UK Offshore OPerators Association, 1997). In addition, post-Kyoto regulatory developments and societal concern over atmospheric pollution (Edenhofer *et al.*, 2004) have increasingly focused on reducing the emission of gases causing global warming, which are majorly associated with the oil and gas industries. In many oil and gas producing countries of the developing world, the operations of the oil industry are especially related to the management of issues like the growing negative environmental and socio-economic externalities of its immediate communities (Utzinger *et al.,* 2005).

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According to Ogri (2001), the lack of a defined effective framework for aggregating the conflicting views of stakeholders on the management of the ROW created across countries by the network of linear infrastructures have been the contributing factor for their continued vandalism and other associated problems.

A geographic information systems-based planning support framework has been used to build an effective model for integrating socio-economic and environmental data bases, which in turn have enabled a number of spatial planning scenarios to be generated, stored, retrieved and updated in response to feedback from pragmatic and just communicative action processes (Petit *et al.*, 2008; Hillier, 1998). This provided the consensus-building avenue for achieving reasonable conditions of collaborative decision making in record time, concerning scenarios of divergent and conflicting interests. Environmental management processes have been enhanced with the introduction of planning support systems in order to manage the conflicts arising from the Harvey Bay pipelines project (Burn, 2007).

2.5.1 The Habermasian debate on collaborative planning

The Habermasian approach to planning argues that planning processes can be better conducted through debates within a framework of dialogue aimed at building consensus amongst the stakeholders of various aspects of planning projects (Fischer and Forester, 1993). In this regard, community action in the planning process is identified as a way through which public planning policies could be subjected to public scrutiny in order to give them legitimacy (Fischer and Forester, 1993; Healey, 1992). Many planning theorists have critically analysed the general notion that the planning process can be contemplated through a process of communicating within and between frames of reference and discourses, which are aimed at engendering consensus among stakeholders and achieving the objective of being legitimated by the communities within which the proposed planning actions will be domiciled (Tewdwr-Jones and Thomas, 1998).

Furthermore, Tewdwr-Jones and Thomas (1998) averred that communicative planning provides a platform through which planners can fully engage with the communities they serve and generate a setting for planning policy discourse that is devoid of the formality that could hinder genuine interaction with stakeholders. Similarly, other collaborative planning theorists have further argued that although

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the democratising appeal of a communicative planning debate is worthwhile (and have the potential of leading to closer working relationships with stakeholders, both public and private), legal and policy constraints often inhibit the translation of community discourses into an implementable policy framework. This goes against the stakeholders' expectations of the collaborative planning process (Booher and Innes, 2002; Huxley, 2000; Tewdwr-Jones and Thomas, 1998).

Fischler (2000) admitted the indebtedness of planning theorists to the work of Habermas on the communicative action model, pointing to the lack of agreement that existed between the Habermasian and Foucauldian ideas as grounds for a radical critique of communicative planning theory. According to him, the inputs of both theoretical ideas flow through current communicative planning theory and collaborative planning process debates, both of which aim for achievement of consensus by stakeholders on a particular planning problem. In the collaborative planning literature, according to (Dredge, 2006), planning is often conceptualised as a suite of democratic processes that do not give rise to problems. He further posited that the process prescribed was unproblematic and that consecutively staged processes are conceived to be amenable to the varying realities of the forms in which problems manifest themselves. In reality, however, the planning process is frequently characterised by conflicts, as well as by decision-making processes that differ based on their contexts in terms of stakeholders, geography, and the legal and administrative frameworks which constrain them (Brand and Gaffikin, 2007; North, 2000). This nevertheless suggests that the conflicting interests expressed by stakeholders regarding the pipeline project in Nigeria can be resolved through the processes of consensus building, so that all stakeholders will come to trust one another and work positively towards the singular aim of having the environment in which they have common interests managed for the benefit of all stakeholders.

Communicative action theory was developed by Johnson (1991) as an expansive social theory rooted in the work of Habermas and, according to him, was constructed around the concept of communicative rationality, with broader normative and empirical concerns necessary for collaborative consensus building for the achievement of set goals. In an attempt at bridging the strategic/communicative action divide, Muller (2004) explained that Habermas placed communicative action in the "life world" (that is, real life contexts) and strategic action in the "system"

(that is, planning systems). He further argued that as an effective collaborative consensus building tool, communicative action is normatively privileged over strategic action in addressing a problem presented in a scenario where stakeholders are unable to agree to a particular course of action in resolving socio-economic and environmental questions.

Communicative action planners and theorists are alert to the injustices engendered by inequalities in power relations (Sager, 2006; Healey, 1997a). They have striven, through the premise of collaboration in the planning process, to develop an explicit strategy for building consensus among stakeholders with the aim of achieving a negotiated solution to planning, environmental and socio-economic challenges. The ROW of petroleum pipelines in Nigeria traverse the country cut across the ethno-cultural and socio-environmental landscape and provides a robust platform for collaborative consensus building for all the stakeholders, including the government, business interests and those in the affected communities within a collaborative action regime. The challenge of building consensus through a socio-cultural and geopolitical landscape connected by petroleum pipelines and their associated ROW, measuring over 7,000 km in length, consistent with the ideals of the communicative action model and the collaborative planning support system, requires a crisis-free management solution to the problem of linear infrastructure, such as roads and pipelines and their associated ROW in the developing world (Kapoor, 2002).

2.5.2 Critiques of the Habermasian approach

The Habermasian work on the communicative turn in planning theory and the recent work based on it by planning theorists has concentrated on the application of collaborative planning ideals to environmental, urban and regional governance (Brand and Gaffikin, 2007). Collaborative construction of planning thought, however, has profound implications for other spatial environmental disciplinary jurisdictions such as geography, where institutional capacity building has been entrenched as part of the local systems of spatial environmental governance (Tewdwr-Jones and Allmendinger, 1998b). It has been realised that both bodies of theoretical work are premised to a certain degree on the rationality of communications amongst stakeholders from participating formal, informal and professional perspectives (Kamete, 2009a; Brand and Gaffikin, 2007).

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According to Tewdwr-Jones and Allmendinger (1998a), the Habermasian principle contrasted ideas about the possibilities for communicative action against the presence of strategic behaviour in varying contexts of social relations. They argued further that the dual nature of governance as both an institutional and a political activity means that consideration of strategic forms of behaviour in social relations is essential for a deeper understanding of the nature of collaborative and associative forms of governance and their outcomes. To the social scientists of geographic and sociological persuasion, strategic action and normatively regulated action, together with communicative action, are all integral to collaborative governance in a spatial environmental sense.

Considerations of the manner in which institutional capacity has been exercised in attempts to attract a major inward investment project into planning jurisdictions in the United Kingdom and the United States illustrate the range of social actions that are present beneath the surface of collaborative and associative governance (Fainstein, 2000; Healey, 1998a). More specifically, the structuring of institutional and organisational interactions through the strategic behaviour of a dominant local organisation impacts on the ability of other stakeholders to participate reasonably in the utopian democratic planning space created in the Habermasian school of thought (Hillier, 2007; Yiftachel and Huxley, 2000b).

The Habermasian general theory of communicative action, according to Hillier and Gunder (2003), has partly developed from Freud's psychoanalytical theory of distorted communication. It was necessarily construed to be communication that is not distorted and is based on the utopian principle of universally unconstrained consensus in the planning process. They posited further that his wider concern was that the state is forced to deal with the dysfunctional side effects of the economic process under fairly restrictive conditions. Similarly, Albrechts (2003) explained further that the Habermasian principle "wished" that communicative action might bring about social relations dominated by mutuality and where satisfaction does not mean the triumph of one over the repressed needs of the other.

Hillier and Gunder (2003) emphasised the importance of power in planning decision making, a dynamic that Habermas has tended to understate in his communicative action theory. Healey (1997b) developed a collaborative communicative theory in

the context of evaluating processes of governance and planning through debate, which varies in theoretical prescription from the stance of Habermas, who contemplated a communicative process that is devoid of perfect order in the contentious social relations generated in planning processes.

From the critiques above, it is evident that over the past decades (Innes and Booher, 2003b), collaborative planning thought has introduced a new paradigm into planning theory. Described by some as the paradigm of the 1990s (Healey, 1996), the collaborative planning principle proposes a fundamental challenge to the practice of planning and seeks to explain not only where traditional planning thought has gone wrong but also to present a way forward. Following the critique of communicative planning action outlined above, broad areas of concern that militate against the option of a collaborative planning approach have become obvious. They include the problematic assumptions in the original Habermasian theoretical construction of communicative action as a separate concept of sociological action that sees approaches to the planning process from the utopian position of the possibility of absolute consensus. Although it is useful to acknowledge the benefits of the collaborative explanation of the planning process and the role of values and consensus-building in decision-settings, it is important to remain aware of the inadequacies of the Habermasian construction of collaborative planning theory. It can be said, however, that these have been adequately remedied to reflect the peculiar political and professional nuances and exigencies that exist in planning practice by the works of collaborative planning theorists in the early 21st century (Hillier and Gunder, 2003; Healey, 1997c).

2.5.3 Citizens participation through Collaboration

Planning policies are targeted at fulfilling the inherent fiduciary responsibility of governmental authorities and other formal stakeholders, such as business and non-governmental organisations, to people in the communities they are meant to serve (Kamete, 2006; Lantos, 2001; Yiftachel and Huxley, 2000a). In reality however, the programmes and content of plans meant to serve people are finalised without inputs from people in the communities they aim to serve (Kamete, 2008b). This means that the people for whom the plans are initiated know little or nothing at all about their content, a development that makes many planning programmes run at variance with

the aspirations of the people they are intended to cater for (Paulo et al., 2007). A result of this, according to Kamete (2009d), has been a continuous attempt at adverse possession of the land taken from the community for implementation of the project. This action, because the people have not participated in its planning and execution, would be interpreted by them as a ploy by the authorities to deny them access to their land. Asserting that there is a link between social movement organisations, contentious politics and governance, Kamete stated:

> *spatial governance involves relationships and interactions. Some of these interactions are between the governors and the governed, between the powerful and the weak. In the relational practice that is governance, stakeholders with certain advantages can deploy these to maintain and protect their favoured position. (Kamete, 2009d).*

This alludes to the thinking that the vast majority of planning programmes are rigidly framed with no inputs from the people the plans are aimed at. Entrenching the plans in the communities is a critical factor for their long term sustainability. Collaboration through community mobilisation, in a way that encourages the formal participation of citizen as stakeholders, is necessary to secure their cooperation. (Kamete, 2008a)

In Zimbabwe, discussions with Harare's youth and planners revealed that the direction, form and content of urban planning there are more or less cast in stone. In most cases, the outcome of planning is a foregone conclusion because planning and environmental management programmes are prescribed with little room for adjustments to accommodate people's post implementation grievances (Kamete, 2009c). This makes it impossible to accommodate post implementation concerns that are outside what has already been approved in plans, regulations and policies that guide development and management of lands that do not fall within the jurisdiction of the local people (Kamete, 2010; Kamete, 2009b; Munzwa et al., 2007). As a consequence, spatial planning practices have inevitably tended not to be in favour of public participation. The most that public can do, when faced with a rigid plan which has the doctrinal endorsement of the authorities, is to present information and raise objections which scarcely can succeed. As Kamete (2006) further argued:

> [...] *it is impossible to integrate meaningful citizen participation in urban planning within the present structural and operational environment. The observed tokenism and placation are the best that can happen under these constraints. For effective participation to be possible, structural transformations, an overhaul of planning practice, and a reorientation of the very spirit and purpose of planning are necessary. (Kamete, 2006, p. 15).*

This suggests that effective participation of the people can have significant benefits for all the stakeholders of a planning scheme. For community-based stakeholders, the benefits will be in terms of enhancing their income capacity though inclusion in the scheme's management processes, because this will ultimately translate into poverty alleviation among the members. For the state and other formal stakeholders, the benefits will be the long term sustainability which is the ultimate goal of planning programmes.

2.5.4 The collaboration imperative of contracting with the people

Collaborating with people has proved to be a veritable means of securing their involvement in the implementation and realisation of long term sustainability in Sri Lanka (Cotton et al., 1998). The success factor in the Sri Lankan community contract initiative lies in the interest people acquired in the project by becoming a stakeholder. This generated a feeling of ownership of the projects by the community, and engendered in them a sense of responsibility for protecting them against vandalism, as this will affect community members who depend on the functioning of the project for their survival. This explains why some community groups who engage in the protection of common community property are able to resolve their collective grievances in a way that will not antagonise their common economic and social interests in public projects on their community land and other land, even when a stake in the project may not have immediate positive economic benefit for them (Goodhand et al., 2000).

In operational terms, collaborating with the people in the host communities of major infrastructures can tap into the existing social capital in order to encourage a focus on developmental interventions that use local organisations, create networks between organisations and use participatory practices for planning, implementing and monitoring activity and diffusing information (Coudouel et al., 2002; Cotton et al.,

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1998). Community initiatives in infrastructural management have achieved the goal of long term sustainability in the management and use of drainage and other transportation projects in Sri Lanka. Similarly, in Ghana, the participation of the people in the Akosombo Dam resettlement project facilitated the relocation of the inhabitants of the 700 abandoned settlements, from many different tribes, to the 52 new towns that were created for them (de Wet, 2005). This made the development of a socially cohesive and integrated community with a viable institutional infrastructure possible after the areas affected by the dam project were flooded.

It can be argued therefore that community stakeholders posses the capacities for a wholly endogenous solution to post-implementation infrastructure management challenges, to the extent that community stakeholders and governmental and other stakeholders can see the long term sustainability of the project as the collective aim of all.

2.5.5 GIS as a planning support system

Langran (1992) stated that the challenge of fixing locations in time and describing the path of an object moving between them must be done by fixing their attributes to represent them within a data base that can be updated regularly, as the geographic features of the earth undergo transformation. This, according to Goran and Finny (1991), is best done using geographic information systems, as this will enable the representation of changes in land cover, movement over given geographic space and prediction in terms of the trends in changes induced by spatial movement, which typify the ROW of petroleum pipelines in Nigeria. Environmental changes and strange movements in the ROW of petroleum pipelines could be tracked using the potential of the geographic information systems to monitor crime.

Similarly, Peuquet (1994) reported that the discrete yet interrelated time, location and object based views incorporated within the framework of geographic information systems allows for queries to be issued and results received relative to each of the aspects of the attribute data within the data base. In relation to the ROW for petroleum pipelines, the features and their corresponding coordinates could be generated, using the global positioning system and geographic information systems, to create a data base into which queries can be input and results obtained depicting

changes that might have occurred to features located on the ROW for linear infrastructures such as pipelines.

Similarly, Egenhofer and Golledge (1998) averred that since geographic information systems include people as a vital component and their software and data input are comprehensible to human users, this method then could lend itself to the management of specific spatial environmental problems, like the ROW challenges in Nigeria. The software must incorporate simple everyday language in its design and development, so that a wider range of people may understand, use and interact with it in seeking answers to spatial and temporal queries. The geographic information systems data base for monitoring the ROW of petroleum pipelines in Nigeria will have to adopt the language style and symbols best understood by the eventual end users of the data base.

Geographic information systems can be specifically designed to relate to defined geographic locations using unambiguous co-ordinates. When input and stored in a geographic information systems data base, queries and answers based on the retrieval system are then enabled for human consumption using the software interface (Martin, 1996; Goran B and Finny, 1991). Similarly, Battacharya (2007) reported the development of a participatory geographic information system that involved the community in the design of geographic information systems data and spatial decision making tools; a process which according to him enhanced the knowledge of the locals. The local communities along the ROW of petroleum pipelines stand to benefit from geographic information systems and land use planning knowledge, since the resultant plan will have their input from the onset and also maintain their knowledge of the situation in line with that of the implementation team.

Brail and Klosterman (Brail and Klosterman, 2001; Goran B and Finny, 1991) canvassed the need to integrate geographic information systems in the overall framework of planning for the organisation and display of spatial data to reduce the time for spatial enquiries. Generating spatial data with accompanying ground control points along the ROW of petroleum pipelines is necessary in designing a data base that will be essential in monitoring and reporting incidents of crime along the ROW of petroleum pipelines in Nigeria.

Goodchild (1987) contended that if a data base contains representation of spatial data, then its data structure is by definition a model of spatial information, which may be used to address terrain-related queries. The data to be generated by working the length of the ROW in Nigeria will produce ground control points with geographic co-ordinates which can be represented in digital elevation models, with the prospect of being deployed for further terrain analyses in the quest for the problems plaguing these areas. However, Harris and Batty (2001) noted the widespread use of geographic information systems in planning, concluding that the effects on the planning process have led to the development of support systems for planning in which a wide array of spatial data and knowledge might be structured in order to simplify the length of time and processes involved in the analyses of spatial data.

According to Goodchild (1992), distinguishing attributes in spatial data is necessary because it is based on two continuous dimensions which make it possible to visit any location with x, y ground point co-ordinates in the real geographical world, provided the co-ordinates are defined with unlimited precision. This will ensure that crimes on the ROW are reported with precision for necessary follow up action. Similarly, Worboys (1994) stated that the geographic information systems description of an object must provide its static properties, behavioural characteristics and structural characteristics, to ensure that entity-based geographic information models fit naturally with object-oriented concepts within the wider geographic information system for ease of analyses.

In the account of Taylor *et al.*:

> [...] *transportation system centre developed integrated global positioning systems- geographic information systems for collecting on-road traffic data from a probe vehicle. A system which was further integrated with the engine management system of a vehicle to provide time-tagged data on global positioning systems positions and speed, distance travelled and other attributes of specific journeys*. (Taylor *et al.*, 2000, p.1)

In relation to pipeline ROW, data collected using the global positioning system connected to a laptop computer in the form of ground control points can be stored for further analysis in the geographic information systems laboratory.

Because ROW is void of a real-time management framework and the communities traversed by most linear infrastructures are not encouraged by law to take positive steps for their management (Fabricius, 2004), criminals have taken advantage by vandalising these public infrastructures across many countries (Onuoha, 2008b). The covert black market vandalism operations of the vandal barons have undermined the integrity of the pipeline networks, to the extent that the government has contemplated burying the more than 7,000 km of pipeline deep into the ground (Chika-Amanze and Edomaruse, 2007). Vandalism activities have even attracted foreign nationals into Nigeria. The arrest and conviction of Ghanaian and Pilipino vandal syndicates indicates an international dimension, which is added to the illegal vandalism run by Nigerians on ROW in the country (Segun and Omo-Julius, 2008).

2.6 Vandalism of pipelines in Nigeria

The implementation of policies exploitative to the population in the oil and gas producing states in Nigeria, and the environmental degradation which results from exploration and production processes, is responsible for the vandalism of oil pipelines in Nigeria (Aaron, 2005).

Aprioku (2003) advocated a comprehensive environmental programme involving the government and other stakeholders, namely oil explorers and host communities, as a way out of the perennial vandalism of oil pipelines and the resultant spillage, which causes large scale socio-economic losses to all parties. According to Ikelegbe (2005a), the Nigerian economy, although not the cause of the ongoing agitation that has occasioned the incessant vandalism of oil pipelines, has underpinned its escalation.

Economic input could be invested in a comprehensive socio-environmental management plan which would aim to educate local people about the effects of infernos resulting from the vandalism of petroleum pipelines. The primary victims have always been the poor, whose skills could have been enhanced for an effective employment role in the management plan.

Canton (2007), in his article titled "Perils of Oil", concluded that oil corporations in Nigeria continue to maintain and improve profits at the expense of the local population who perpetually wallow in poverty. This scenario of wealth and poverty, co-existing side by side in the oil producing areas, and the resultant agitation, can be remedied with the development of a plan in which the local people have a stake.

Nwilo and Badejo (2006) argued that the discovery of oil in Nigeria in 1956 has progressively contributed suffering to the majority of Nigerians, especially in respect of the environmental consequences of oil exploration and exploitation. Yet the reverse should have been the case: the people should have been the beneficiaries, and not the victims, of oil exploration activities in Nigeria. Nevertheless, the situation is reversible with the involvement of the people in the preparation and eventual operation of a properly crafted plan for the management of the areas directly affected by the exploitation and distribution activities in Nigeria.

Omeje (2006a) noted that the incidence of vandalism of oil pipelines is a case of theft of public goods and deliberate sabotage of national and international efforts at developing the oil industry in Nigeria. He canvassed the implementation of a commercialised security approach to the problem, but did not suggest any framework within which to achieve this noble goal.

Ogboyi (2007) identified sustainable development planning as a medium within which multi-national oil companies can engage in meeting the developmental needs of the oil producing areas in Nigeria. For this to be achieved, the people in the affected area should be included in the development and eventual implementation of the management framework. Oyefusi (2007a) linked the problem of petroleum pipeline vandalism in Nigeria to the exclusive government dependence on oil revenue, institutional instability in revenue allocation, and the failure to translate oil wealth to the sustainable development of other factors. A management framework for the ROW of petroleum pipelines would provide a meeting point for all the contending interests seeking a solution to the problem.

Jackson (2007) identified political agitation for the control of the wealth derivable from oil exploration and criminality as reasons for the constant vandalism of oil pipelines in Nigeria. A framework that accommodates the genuine grievances of the people in such a way that they will begin to approach the development of oil and its related activities in the hope and spirit of a common heritage could count towards remedying the situation.

Furthermore, Olukoju (2004) identified petroleum pipeline vandalism as a contributory factor in the unreliable electricity situation in Nigeria, and one which has forced people to choose electricity generating sets as alternative sources of energy. He further said that the situation is presently so bad that the people no longer expect power from the public source of supply.

2.7 Chapter summary

This review has shown the tensions and strain between the actors in the social system that are common to the fiduciary relationship that exists between businesses such as oil companies, the state and the host communities in which these operate. This un-negotiated relationship has always resulted in the businesses and the state taking sides to the disadvantage of the weaker parties (the host communities) and, as a result, the communities are left in poverty with a decayed infrastructure, in contrast with what exists in the communities inhabited by the staff of the big organisations. These organisations are located and, in most cases, are destroying communities which were largely content with the hitherto serene natural environment.

The review indicates that the deliberate means through which corporate organisations and the state might honour their fiduciary duties to these communities are to be found in the equitable concept of corporate social responsibility (Matten and Moon, 2008; Jenkins, 2005; Aguilera et al., 2004). This equitable concept provides a means of providing and preserving the basic structure of the system and adjusting to changing conditions within the framework that the basic structure provides (Jenkins, 2005). The social contract commitment of business to the community, if delivered properly, is a commitment towards the demands of the universal concept of sustainable development (Brundtland, 1987; World Commission on Environment and Development, 1987). Furthermore, the review

shows that the objectives of corporate social responsibility, as a commitment towards the ideals of sustainable development, can be implemented through a framework based on the principles of collaborative planning practice, which provides for the democratisation of the processes involved in taking decisions about the environment with other stakeholders.

As Idemudia (2007) advocated, the building of corporate partnerships with host communities is the needed antidote to the frequent vandalism of petroleum pipelines in Nigeria. This partnership can be built around a framework that will be mutually beneficial to the host communities and the other interested parties, so that the former rediscover their willingness to ensure the protection of public properties, particularly the pipelines that traverse their communities. According to (Akpan, 2007), the exploitation of petroleum and solid mineral resources has had an adverse impact on society and the environment in Nigeria. This impact can be mitigated within a specifically designed framework, based on data input from the areas affected by the environmental and socio-economic impacts of petroleum resource exploitation and distribution in Nigeria.

The literature review for this study has also been summarised in a succinct tabular format below, with table one detailing the different models of corporate social responsibility. Table two presents the key arguments for the sustainable development concepts from the perspective of public infrastructure management and table three presents the key elements of the collaborative planning debate.

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Table 1: Corporate social responsibility debate summary

Types of theory	Approaches	Outline description	Key references
Instrumental theory, focusing on achieving economic objectives through social activities	Maximisation of shareholder value and maximising strategies for competitive advantage	• Long-term value maximisation • Social investments in a competitive context • Strategies based on the natural resource view of the firm and its dynamic capabilities • Strategies for the bottom of the economic pyramid	(Welker, 2009; Dahlsrud, 2008; Aguilera et al., 2004; Jenkins, 2004; Bowen, 2002)
Political theory, focusing on a responsible use of business power in the political arena	Cause-related marketing, corporate constitutionalism, integrative social contract and corporate citizenship	• Socially recognised altruistic activities as a marketing instrument • Social responsibilities of businesses arise from the amount of social power that they have • Assumes that a social contract between business and society exists • The firm is understood as being like a citizen, with actual involvement in the community	(Husted and Allen, 2006; Davis, 2005; Birch, 2003; Matten and Crane, 2003; Williams, 2001; Burke and Logsdon, 1996; Davis and Thompson, 1994)
Integrative social contract and corporate citizenship theory, focusing on the integration of social demands	Issues management, public responsibility, stakeholder management, corporate social performance	• Corporate processes of response to those social and political issues which may impact significantly • Law and the existing public policy process are taken as a reference for social performance • Balances the interests of the shareholders and stakeholders of the firm' • Searches for social legitimacy and processes to give appropriate responses to social issues	(Mohanty, 2007; Moon et al., 2005; Vogel, 2005; McWilliams and Siegel, 2001; Moir, 2001; Davenport, 2000; Donaldson and Dunfee, 1994)
Ethical theory, focusing on the right thing to achieve in a good society	Stakeholder normative theory, universal rights, sustainable development, the common good	• Considers fiduciary duties towards stakeholders of the firm. • Its application requires reference to some moral theory (Kantian, Utilitarianism, theories of justice, etc.) • Frameworks based on human rights, labour rights and respect for the environment • Aimed at achieving human development considering present and future generations • Oriented towards the common good of society	(Freeman and Velamuri, 2008; Frynas, 2005; Garriga and Melé, 2004; Maignan and Ferrell, 2004; Schwartz and Carroll, 2003; Harrison and Freeman, 1999; Swanson, 1999; Waddock and Graves, 1997)

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Table 2: Sustainable development debate summary

Types of theory	Approaches	Outline description	Key references
Universality of the concept of sustainable development	Initially intended to highlight environmental sustainability but has since included issues relating to social and economic considerations in the development process	• Long-term value of resource use maximisation • Seeks to meet the needs of the present generation • Seeks to do so in such a matter that the ability of future generations to meet their own needs is not compromised	• (Tipple, 2006; Bruno and Karliner, 2002; Dernbach, 1998; Brundtland, 1987; World Commission on Environment and Development, 1987)
Agenda 21 as the universal plan of action	The global plan of action on sustainable development called Agenda 21 advanced a set of programmes in areas ranging from trade-offs on developmental programmes based on environmental considerations	• Sustainability as postulated by Agenda 21 rests on three pillars: social, economic and environmental sustainability.	• (Schipper and Pelling, 2006; Du Plessis, 2002; Bryant, 1998; Doyle, 1998; Mitchell, 1996)
Building high level national commitments	Engendering effective proactive comprehensive planning for national strategies to mitigate negative externalities of physical development	• Creating enabling policies which deal with regulatory mechanisms, administrative readjustment, economic incentives, and the dissemination of knowledge and information campaigns about the risks of unsustainable environmental behaviour	• (Rakodi et al., 2002; Lafferty and Eckerberg, 1998; Brundtland, 1987; World Commission on Environment and Development, 1987)
Local and community context for actions as driving forces in the sustainable development process for the management of public infrastructures	Stakeholder normative theory, universal rights, sustainable development, the common good	• To achieve communities' overall macro-economic, social and environmental development goals, within the purview of Agenda 21, local authorities require management structures which are not only efficient, transparent and accountable, but also recognise the people as a stakeholder. They need to redirect their role away from controlling and towards enabling development in order to gain and sustain the confidence of the people	• (Brandon and Lombardi, 2010b; Neville and Smythe, 2009; Tipple, 2006; Tobin, 1999)

Table 3: The collaborative planning debate summary

Types of theory	Approaches	Outline description	Key references
Habermasian communicative action theory	The planning process can be better conducted through debates within a framework of dialogue aimed at achieving consensus amongst various stakeholders of various planning projects.	• Critically analysed the general notion that the planning process can be contemplated through a process of communicating within and between frames of references and discourses aimed at engendering consensus amongst stakeholders and achieving the objective of legitimacy from the communities wherein proposed planning actions will be domiciled	• (Tewdwr-Jones and Allmendinger, 1998a; Habermas, 1992; Habermas and McCarthy, 1985)
Collaborative planning practice	Planning through debates and consensus-building principles. Emphasises the potential for collaborative discussion of shared concerns about local environmental change	• The planning processes can be better conducted through debates within a framework of dialogue aimed at building consensus amongst the stakeholders of various areas of planning projects • Collaborative communicative theory in a context of evaluating processes of governance and planning through debate. These vary in theoretical prescription the stance of Habermas which contemplated a communicative process that is devoid of perfect order in the contentious social relations generated in the planning processes	• (Neal, 2010; Hillier, 2007; Healey, 2004; Barratt and Oliveira, 2001; Healey, 1998b; Tewdwr-Jones and Thomas, 1998)
Collaborative geographic information system	Collaboration of stakeholders can be enabled through the agency of the geographic information systems. This will ensure that for all the various stakeholders on the ROW, a consensus building avenue across the communities traversed by linear infrastructure	• Geographic information systems based planning support framework has been used to build effective models for integrating socio-economic and environmental data bases, which enable a number of spatial planning scenarios to be generated, stored, retrieved and updated in response to feedbacks from pragmatic and just communicative action processes	(Battacharya, 2007; Egenhofer and Golledge, 1998; Martin, 1996; Peuquet, 1994; Langran, 1992)

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Table one displays in a single page the issues that emerged as salient in the review of literature relating to corporate social responsibility (CSR). It describes the key features of the various CSR models and gives an operational description of the approaches through which they are delivered in host communities and to stakeholders. The table also lists the key references that shape academic arguments in this area of social science discourse, such that the research underpinnings for the concept are elucidated.

In table two, debates around aspects of the concept of sustainable development are presented, with a clear mention of Agenda 21, which forms the global operational plan of action for implementing the ideals of the concept. The table also describes the concept's key features and lists key references that shape the debates. Table three summarises the debate on Habermasian communicative action theory and the concept of collaborative planning practice, and includes a presentation of collaborative GIS. The table also explains the features of these concepts in outline and gives the key references that shape the debate in each of these domains of social science discourse.

2.8 Implication of the review

The review has highlighted a range of themes and procedures which can be understood as four interconnected dimensions, present in every social and environmental phenomenon that hinges on the management of public infrastructures. This suggests that the concept of the management of public infrastructure that affects an array of stakeholders within society must be approached from the point of view that the business interests in the infrastructures, which span corporate business and governmental authorities, must be responsible with regard to the fiduciary relationship that exists between business concerns and the host communities. The primary concerns of businesses generally, and specifically those that operate major infrastructural facilities such as pipelines in the extractive industries, are wealth creation, as has been pointed out above. These concerns are rooted in capitalist cultural values regarding the free market, private property and the fact that wealth creation is good for society. This shows that certain values are already present in businesses in free market economies that tilt them towards the host communities, in

so far as the law would allow, even though these are frequently being questioned because of environmental impacts and other externalities of businesses that operate major infrastructures, such as pipelines, in communities around the world.

It has also become clear that companies which operate infrastructures, such as pipelines, that impact negatively on the environment and social fabric of their host communities, owe a duty to devise a means of mitigating the negative externalities of their business operation on the host communities. This means that the satisfaction of all stakeholders involved or affected by businesses, such as those which transmit oil and gas through pipeline networks, is the greatest possible social asset attainable, wherein most stakeholders find equitable satisfaction without detriment to others.

Furthermore, the presence of negative social and environmental externalities as a result of business operations gives rise to a number of other problems which in the case of the Nigerian pipelines has resulted in what is now called pipeline vandalism (Onuoha, 2009). This also leads to chains of secondary effects, which in the context of ROW in Nigeria, have become a source of continuous corporate actions that burden host communities, but at the same time benefit other stakeholders, like the government and the multinational oil and gas companies (Frynas, 2001). A system must therefore be put in place to manage these externalities through a collaborative framework that enforces the corporate and statutory stipulations of the oil companies' and state's fiduciary duties to the host communities, by offering them a minimum package of rights, privileges and obligations in the management of pipelines and the associated ROW in Nigeria. In so doing, the state and businesses that profit from the pipelines would then contribute to the welfare of society through the compliance mechanism which the collaboration-based management framework provides.

This review also shows that the concept of sustainable development is not only contestable, it is also ideologically controversial and prescribes multiple objectives and complex interdependencies between man, technology and the natural environment, and places a considerable moral burden on the adventurous corporate business world to operate within the remit of environmental, social and economic sustainability. The review revealed that the concept has become popular and has introduced an important element to the debate on corporate social responsibility,

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wherein a collaboration-based management framework has been constructed, in order to explain how and why partnerships amongst the pipeline stakeholders must be built and how to determine, measure and continually evaluate partnerships, so that a workable solution to the many problems identified regarding pipeline ROW in Nigeria is institutionalised.

CHAPTER 3

LINEAR INFRASTRUCTURE MANAGEMENT CHALLENGES

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3.1 Introduction

Following the introductory chapter, chapter two reviewed literature on corporate social responsibility, sustainable development, collaborative planning and geographic information systems for planning support. Building upon the knowledge gaps identified, this chapter gives a global perspective on the challenges of linear infrastructure and particularly, petroleum pipelines, as a necessary step towards articulating a methodology for the study.

3.2 Pipeline as a linear infrastructure

Infrastructure is defined as the basic facilities, services and installations needed for the functioning of a community, society or country, including transportation and communications systems, water and power lines, and public institutions. Societies invest in infrastructure to meet their current and future needs and thus infrastructure reflects the evolution from simpler to more complex technologies, and, in many parts of the world, increasing efficiency in terms of uninterrupted functioning allows greater safety for society as a whole (Lukasik *et al.*, 1998).

Services that are diminishing due to infrastructure damage move society towards less comfort and safety, from plenty to scarcity, from richness to want. Societies recognise their critical dependence on these infrastructures and services, and adopt policies and processes to ensure their safety and to protect them from damage and misuse. Conversely, attacking a society implies threatening its people and infrastructure systems. Denial of access to such basics as water, energy, and transit has been described as a form of international conflict that threatens a nation's security and often leads to war (Orszag, 2003; Lukasik et al., 1998). The industrial revolution greatly increased the extent and complexity of the world's infrastructure, its connectivity, and its technical and economic interdependencies.

Developed nations according to Smith (2002) have, over the past generation, entered a second, equally significant, period of information revolution. Information technology penetrates into many aspects of life for an increasing number of people throughout the world, enriching society but also producing systems of such complexity that they create new dependencies and risks to society in the event of attacks and service disruption. Since World War II, according to Orszag (2003), attacking infrastructure has been the primary way in which hostile powers seek to endanger a nation's security and safety; and hence there is a need to invest in efforts aimed at protecting them (Moteff, 2005).

National infrastructures are so large, complex, and intertwined that understanding how they work, how they fail, and how best to protect them is a significant problem. Modelling and simulation is one tool that can be used to explore these problems (Smith, 2002). Simulation tools that capture the behaviours of the systems, the relationships within and between systems, and that have some ability to measure the impacts of disrupting these systems, are an essential part of an effective plan for protecting the infrastructure. Advances in GIS technology have made it possible for its deployment for the management of infrastructures, particularly linear infrastructure (Quinn et al., 2007).

3.2.1 GIS as a support system for linear infrastructure management

GIS technology can play a decisive role in promoting economically and socially feasible solutions to the existing spatial problems of infrastructure management. This can be done by using GIS to collect the variety of information on the infrastructure and integrating this into a process for monitoring, and evaluating the infrastructure networks (Groot and Sharifi, 1994). To manage the infrastructure sustainably, infrastructure managers need to know what information exists about it and how to obtain and update it, so that it reflects the vagaries of the environment around the infrastructure. GIS, according to Quinn *et al.* (2007), provides this utility .

The major challenges for managing linear infrastructures today are due to its interconnected nature. Using GIS to understand the complex interconnectedness of linear infrastructure in today's global environment is considered vital for the long term viability of the system (Budic and Godschalk, 1994). National security is

measured in both economic and military terms, and a nation's social advancement and world competitiveness rely upon efficient, robust and secure information systems, electrical power, transportation and other critical infrastructures (Quinn *et al.*, 2007; Chen *et al.*, 2003; Anderson, 2002).

Development in applied informatics and digital data acquisition, according to Quinn *et al.* (2007), has led to advances in GIS technology which integrates acquisition, processing and presentation of spatial data. According to (Jones et al., 1997), GIS technology has the capacity to integrate and customise the spatial features needed for the management of the linear infrastructure. This proved useful in Virginia's Critical Infrastructure Protection Study, which implemented risk assessment and management methodologies through eight case studies located in the state of Virginia (Jones *et al.*, 2003). The research was undertaken because of a growing national concern regarding infrastructures that are so vital that their incapacity or destruction would jeopardise US security. Furthermore, the project's pertinence became more palpable in the wake of 9/11.

Infrastructure managers at all levels face unprecedented challenges today (Roper, 2002). Increasing demands are being placed on efforts to preserve the existing infrastructure system and to take on new missions of improved system safety and security. A variety of advanced technologies is being developed to enhance the planning, design, management, operation and maintenance of all aspects of national public and private facilities in the United States. The national transportation infrastructure system, according to Roper (2002), is one example of a major part of the United States' infrastructure system and a critical asset for national growth and development that requires real-time virtual protection.

Aerial and satellite remote sensing represents one area of rapid development that can be leveraged to address these challenges. These technologies have significant and unique potential for application to a number of cross-cutting linear infrastructure security issues. Such information systems were deployed and proved very useful and applicable in the recovery effort in New York City, where geospatial data were generated in only three hours after the two jets crashed into the Twin Towers of the World Trade Centre (Roper, 2003).

Due to the recent growing popularity and utility of global positioning systems (GPS) and further advances in satellite technology, the possibility of their hybrid performance in the monitoring of critical linear infrastructure is being explored (Roth and Schick, 2000). It is now becoming clear that due to the work of Roth and Schick (2000), the adoption of a GPS system unsupported by other such applications has limitations in the pursuit of quick and accurate solutions to terrain-related environmental problems. Consequently, systems of this kind that can work to complement GPS are being evaluated. For example, Loran technology, which consists of software that permits the interface of, and data management generated by, four hardware products has been reported by Roth and Schick (2000) to be uniquely amenable and suited to complementing GPS in resolving terrain-related problems.

The United States of America is reputed to have the most extensive, complex and arguably the most sophisticated systems of public infrastructure in the world (Little, 1999). This linked system of facilities and activities provides the essential services that support national economic wellbeing and overall quality of life. Despite the very critical role public infrastructure plays in countries' welfare, it increasingly faces daunting challenges which professionals in various fields are working to resolve, in order to guarantee that their infrastructure can continue to operate to deliver services for the overall good of the society. The required framework for an all-stakeholder inclusive management instrument for transnational infrastructures could potentially be provided by a hybrid of geographic information systems and spatial planning (Roper, 2003; Roth and Schick, 2000).

The hybridisation of GPS and spatial planning principles has been reviewed (Roth and Schick, 2000) and related in particular to the context of contemporary collaborative planning debates and geographic information systems infrastructure upgrades for real time monitoring and terrain analyses. The reliable accuracy of geographic information-based planning support systems has been demonstrated on woodlands. A planning support system that combines a geographic information systems data base and trained human agency working in tandem, offers distinctive possibilities for resolving terrain-related challenges (Roper, 2002; Roth and Schick, 2000). Geographic information systems integrated in collaborative planning practice offer ingenious solutions that can be streamlined and updated periodically by

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generating new data that reflect changes with large-scale impacts, having implications for the terrain covered by the data base.

Energy infrastructure is faced with issues of deregulation in many countries, coupled with interdependence on other critical infrastructure and an increased demand for high quality in its various dimensions. There is more and more stress on the supply of services to economies that are fast becoming digital due to unprecedented advances in information and communication technologies (Amin, 2005). The issues involved in managing disaster are extremely heterogeneous. In order to develop effective systemic solutions to the needs of a particular community, any framework must address the need to effectively and efficiently share information across institutional boundaries within and between the groups that make up that community. In essence, an interface must be specified at each boundary that separates levels in an agency or at the juncture between different agencies or between different sectors (Roper, 2003). These interfaces each have at least three components, namely: technical, human and institutional.

3.2.2 Integrating spatial data into GIS

The importance of integrating spatial data into the GIS is important in resolving the difficulty of implementing them in an automated context (Le Grand *et al.*, 2003). For instance, the lightest weight interfaces should be between levels within the same entity within a single sector; while, by contrast, the heaviest interfaces would be those that attempt to span sectors. Our current societies are fully dependent on large complex critical infrastructures (Le Grand *et al.*, 2003). These infrastructures are large scale distributed systems that are highly interdependent, both physically and in their greater reliance on the information infrastructure, which logically introduces vulnerabilities. Failures, accidents, and physical or cyber attacks can cause major damage, which can proliferate by generating chains of effects that then severely affect a part, or the whole, of a society (Warner *et al.*, 2007). Protecting infrastructure GIS depends on improving our ability to integrate information from many sources not only within an organization but between organizations, and on the integration of the GIS-based analysis into decision making processes which always require custom made solutions (Luiijf *et al.*, 2003; Hamza, 2002).

Spatially, data processing for terrain around infrastructures has become more sophisticated, as the requirement to locate processing close to the user has become greater (Harris and Batty, 2001). The importance of GIS in this context lies in its utility in integrating the involvement of users and the people affected by linear infrastructure. This feature makes it possible to engender greater popular participation that can improve collaboration across stakeholders for the management of infrastructures like roads and pipelines that traverse communities (Pinto *et al.*, 2003). This leads to a decentralised arrangement for continuing data updating and processing information on the geographically dispersed length of the linear infrastructure, which can connect the stakeholders in a coordinated and connected programme that responds to environmental and societal dynamics.

It has also been shown that it is important to create decentralised data resources as a necessary fulcrum for participatory collaboration with the advantage of greater user involvement (Roche and Humeau, 1999). This places a significant responsibility on coordination activities, requiring centralized coordination components in the form of governmental authority, which encompass functions such as policy directions, standards definition, quality assurance, and localised priorities within the communities.

With GIS technology, spatial information can be shared by an entire application sector which in the case of the pipeline would include the stakeholders. This has been defined as including: the communities, the oil companies and the government. The implication is that each stakeholder will then have privileges and responsibilities accruing to them from their shared management responsibility over the ROW (Robey and Sahay, 1996). Community-based stakeholders would then have responsibility for maintaining and operating the GIS system, and updating the database to keep the technology current (Sieber, 2006). After creating the needed data infrastructure within the ROW communities, it is then important to activate people's participation so that they can interface with other stakeholders in the management of the ROW.

Since GIS can be deployed in demarcating and formalising land rights through a process that is known and acceptable to all the stakeholder-users (McCall, 2003), it can be deployed to demarcate linear infrastructure such as the ROW infrastructure in

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communities. A ROW regime can then be introduced that is acceptable to the people in the communities and their formal counterparts represented by the oil companies and the government, in a context that satisfies the perceptions and expectations of the people and meets the legal requirements of the state. For the mapping process for demarcating the ROW to attract people's participation, it must be reflective of the perceptions and feelings of the people, so that any strong views they may hold are reflected and integrated within the mapping programme (Phillips, 2005; Staal *et al.*, 2002).

As Sieber (2006) explained, participatory decision-making in neighbourhood management can be furthered by an interactive, real-time collaboration aided by the GIS technology. Similarly, GIS technologies have been used to engender people's participation in conflict management processes within communities, on issues relating to location choice for community utilities and services such as power lines and spatial housing locations (Scaparra and Church, 2008; Robey and Sahay, 1996). Likewise, the spatial data output demarcating the ROW will resolve the issues relating to the non-identification of the pipelines, as the people in the communities and the other stakeholders will now have the necessary knowledge to claim their part of the responsibilities for the pipelines management.

McCall (2003) used GIS to analyse indicators of poverty within rural and urban communities. He mapped the deprived groups of the society as distinct zones of deficiency with the aim of managing environment-related poverty problems. In the ROW infrastructure, GIS can be used to map the communities and correlate this with the activities of other stakeholders so that the kinds of marked imbalances that would breed disaffection between the different groups is identified and deliberate actions are taken to address them. This analytical utility of the GIS can be applied to engender participatory, interactive and communicative processes towards collaborative planning for focus group meetings. It can also support scenario assessment on the ROW where a collaborative model is simulated that can be tested, updated and integrated into the ROW management. This technique holds the potential not only to define the role of the different stakeholders in the participatory process, but to continuously update the stakeholders' role, based on changing power relations over time.

3.2.3 GIS and spatial infrastructure representation

Spatial infrastructure such as the ROW has component stakeholders who are often dispersed over large areas and at the same time, for a sustainable collaborative management infrastructure relies on each component stakeholder in order to function, irrespective of the location of these components (Innes and Booher, 2003a). Modelling an interfacing process for the stakeholder components is therefore is necessary to sensitise elements towards mutual integration.

The modelling and simulation of infrastructure elements, and particularly of interdependencies and risks to those elements, can be performed on the basis of a geographical information system providing a common semantic basis for presentation and analysis, as well as a mechanism for sharing only selected and, where necessary, downgraded information with other infrastructure operators, in order to identify and deal with any threat before it becomes a disaster (Wolthusen, 2005).

The 2003 blackout in the USA underscored concerns about the vulnerability of national critical infrastructure to both accidents and deliberate attack, providing an immediate connection to US homeland security efforts (Orszag, 2003). The blackout offered deeper lessons beyond the vulnerability of the national electricity grid to terrorist attack. In particular, a common explanation for the problems facing the electricity system, according to Orszag (2003), is that private firms have had inadequate incentives to invest in the protection of their distribution lines.

Major government initiatives have been undertaken regarding the protection of critical infrastructure protection in recent years in the Netherlands (de Bruijne and van Eeten, 2007). This is in a context of massive institutional restructuring under the policy of privatisation, deregulation and liberalisation, resulting in a level of fragmentation that has caused the management and control of infrastructure in that country to be confronted with less than adequate or delayed information and control in the proactive management of infrastructure. This presented a new set of surprises in human and environmental externalities that threaten infrastructural reliability and service, with implications for large societal costs due to large scale failure or

sabotage, representing new challenges for public infrastructure managers globally (de Bruijne and van Eeten, 2007).

Threats, risks and vulnerability are issues of management uncertainty confronting critical infrastructure such as oil and gas pipelines, roads and electricity lines, in the kingdom of Bahrain in particular and the world over (Hamza, 2002). Comprehensive national efforts rooted in research have led to the institutionalisation of a national infrastructure management plan in Bahrain that encompasses disaster mitigation, emergency preparedness and response and disaster recovery services that are fit for purpose. The ubiquitous nature of energy infrastructure such as petroleum pipelines and electricity lines and their associated ROW makes them convenient targets for terrorism, resulting in service disruption and other unquantifiable damage to the environment (Torbin, 2003; Hamza, 2002).

Developed economies like the United States have an energy infrastructure that consists of miles of overhead electric transmission lines and underground oil and natural gas pipelines. While the US infrastructure is constructed of simple and easily repaired hardware, the ubiquitous nature of the hardware also makes it a convenient target for terrorism. A disruption in service has the same impact on users regardless of whether the cause is a natural one (hurricane or earthquake) or man-made (terrorist attack). Likewise, the response is the same regardless of the initiating event. Unfortunately, the loss of service is usually long-term and has a national impact estimated in billions of US dollars. Efforts at developing a workable management plan must be focused on directing attention to better (real-time) monitoring of linear infrastructure networks to shorten the response time after an event rather than focusing on the present reactive approach, which has proved ineffective in preventing and/or mitigating an attack, service breakdown and avoidable loss of life (Torbin, 2003).

Although infrastructure is often discussed in terms of hardware such as pipelines, roads and electricity lines, it is the service which it produces that is of real value to society (Little, 2004); hence, the definition of infrastructure should encompass institutions and people in addition to technological artefacts. Infrastructures are only viable if they are supported by organisational and social systems that operate to protect and maintain them within the increasingly fragmented, socio-

environmentally diverse spatial context in which they exist (Little, 2004; Federal Environmental Protection Agency, 1991). Heavy infrastructure such as oil and gas pipelines and electricity lines is essentially a socio-technical system, that, according to Little (2004), consists of the assemblage of technological artefacts, human elements and organisational frameworks and procedures that combine to deliver a product, service or public good. While the relative importance of any component of the overall system may vary, all, according to (Little, 2004), must be present to enable the effectiveness of the system in the delivery of the service, product or public good. In the operations around the petroleum product pipelines and their associated ROW in Nigeria, while the technological artefact symbolised by the pipeline itself exists, the other two vital components, namely the human element and the institutional framework (Lukasik *et al.*, 1998), do not.

The involvement of civil society in the management of the environment and other public goods, particularly oil and gas pipelines, has made a substantial contribution to improvements in environmental management in Russia (Wernstedt, 2002). It has afforded a public/ private coalition for consensus building, and a periodic review of contending issues that informs policy decisions and makes a proactive contribution to the management of environmental issues relating to the ROW of petroleum pipelines. This kind of framework, if made operational around the virtual monitoring capabilities of geographic information systems, holds the potential to resolve the crisis on the petroleum pipeline ROW in Nigeria.

A task force set up for the implementation of such an option in the management of critical environmental issues which are perturbing the operation of a massive, critical, state-owned infrastructure has recorded tremendous success (Federal Environmental Protection Agency, 1991). In this case, the approach included an economic incentive option which was meant to influence rather than dictate action in the task of environmental management and infrastructural protection. The option of incentives as part of a broad based management plan for the ROW of petroleum pipelines has the potential to positively engage and influence criminal elements to turn their energy towards the protection of the unprotected ROW. It can also propel corporate organisations, both public and private, into evolving corporate

responsibility programmes that will engender a protective approach towards the ROW of petroleum pipelines in their host communities.

According to Phillips (2005), infrastructural surveillance must entail everyday, taken-for-granted, institutionalised and technically mediated practices which will identify, observe and analyse individual actions in relation to the management of public infrastructure and goods, within a socio-technical framework that is capable of reporting system failures to appropriate human and service agencies and also delivering appropriate response services in the event of an emergency. The initiative Phillip describes created a general purpose, location-specific surveillance infrastructure, capable both of surveillance of broad patterns of activities and of responding to particular individual events.

Clarke (2003) reported that it was the field of town planning that first started to exploit thematic maps, by extracting data from one map to superimpose on another, thus engendering the academic revolution that has resulted in the now elaborate use of geographic information systems for solving terrain-related environmental problems (such as the one presented by the ROW of petroleum pipelines in Nigeria). Similarly, Langran (1992) stated that the challenge of fixing locations in time and describing the path of a moving object must be done by creating fixed attributes to represent them. This can best be done using geographic information systems, which can represent changes in land cover and movement over a given geographic space, and predict trends in changes induced by the spatial movement which typifies the ROW of petroleum pipelines in Nigeria. Environmental changes and unexpected movements on the petroleum pipelines ROW could be tracked using the potential of geographic information systems, for the purpose of monitoring against crime.

Kelvin *et al.* (1994) reported how an integration of geographic information systems and computer-aided design can be used to visualise landscape changes. The main goal of their project was to develop a modelling process whereby features and their attributes in a geographic information systems data base are used to construct 3D objects in a computer-aided design system, which when assembled constitutes simulated views of the visual landscape under consideration.

Kwan and Lee (2004) illustrated the analytical value of time-geographic methods in a near precise description and analysis of human activity patterns using the representational and computational capabilities of geographic information systems, owing to the possibility to geo-reference individual-level data which can be deployed for effective exploratory spatial analyses. This exploratory capability of geographic information systems can be deployed to analyse the spatial-temporal interaction on the ROW of petroleum pipelines in the consensus building process aimed at evolving a management plan for the ROW of petroleum pipelines in Nigeria.

The view created using the instrument of geographic information systems, with its virtual reality-style interface, would enable the creation of an interactive virtual environment that not only contextualises the visualisation of the actual geographical reality (Kwan and Lee, 2004) but also enables the analyses of location-specific variations in the vagaries of the spatial environment along the ROW of petroleum pipelines in Nigeria. As individual-level geo-reference data becomes increasingly available, the development and implementation of these kinds of geo-visualisation methods for spatial-temporal environmental management is simplified (Kwan, 2004).

Peuquet (1994) stated that the discrete yet interrelated time, location and object-based views incorporated within the framework of geographic information systems allows for questions to be asked and answered relative to each of those aspects of the attribute data on the ROW of petroleum pipelines. Their corresponding coordinates could be generated using the global positioning system and geographic information systems to create a data base into which queries can be input and answers obtained, thus supporting efforts to manage the petroleum pipelines ROW. The need for a planning support system for the resolution of terrain-related problems is enormous (Geertman, 2002). The possibilities presented in geographic information systems are amenable to configuring feasible solutions for identified socio-environmental problems.

Egenhofer and Golledge (1998) contended that since geographic information systems include people as a vital component, it is therefore vital that the software and data input be comprehensible to all users. The software must incorporate simple, everyday language in its design and development so that a wider range of people

may understand, use and interact with it in seeking answers to spatial and temporal queries. The geographic information systems data base for monitoring the ROW of petroleum pipelines in Nigeria will have to adopt the style of language and types of symbols best understood by its eventual end users.

Martin (1996) described geographic information as relating specifically to defined geographic locations with unambiguous co-ordinates. When fed into and stored in a geographic information systems data base, queries and answers based on the retrieval system are then enabled, with humans using the software interface. Battacharya (2007) reported the development of a participatory geographic information system that involves the community in the design of geographic information systems data and spatial decision-making tools, a process which according to him enhanced the knowledge of the locals. The local communities along the ROW of petroleum pipelines stand to benefit from geographic information systems and land use planning knowledge, since the resultant plan will have their input from the onset and also maintain them in the implementation team.

Brail and Klosterman (2001) canvassed the need to integrate geographic information systems in the overall framework of planning for the organisation and display of spatial data to reduce the time for spatial enquiries. Generating spatial data with accompanying ground control points along the ROW of petroleum pipelines is necessary for designing a data base that will be able to support monitoring and reporting incidents of crime along the ROW of petroleum pipelines in Nigeria. Goodchild (1987) contended that if a data base contains a representation of spatial data, then its data structure is by definition a model of spatial information which may be used to address terrain-related queries. The data to be generated by working the length of the ROW of petroleum pipelines in Nigeria will produce ground control points with geographic co-ordinates which can be represented in digital elevation models, with the prospect of being deployed for further terrain analyses in the quest for the problems plaguing the ROW of petroleum pipelines in Nigeria.

(Harris and Batty, 2001) acknowledged the widespread use of geographic information systems in planning, concluding that the effects on the planning process have led to the development of a support system for planning in which a wide array of spatial data and knowledge might be structured in order to simplify the length of

time and processes involved in the analyses of spatial data. As stated by Worboys (1994), a geographic information systems' description of an object must include its static properties, behavioural characteristics and structural characteristics, to ensure that entity-based geographic information models fit naturally with object-oriented concepts in a wider geographic information system, for ease of analyses.

Similarly Taylor *et al.* (2000) described how a transportation system centre developed an integrated global positioning system/ geographic information system for collecting on-road traffic data from a probe vehicle. This system was further integrated with the engine management system of a vehicle to provide time-tagged data on global positioning systems positions and speed, distance travelled and other attributes of specific journeys.

3.3 Global context of pipeline management challenges

The era of the industrial revolution greatly increased the extent and complexity of infrastructure in America and this has implications for its connectivity and technical and economic interdependencies (Amin, 2008; Rinaldi et al., 2002). America has, over the past generation, entered a second, equally significant, period of information revolution (Masera, 2005). Information technology affects many aspects of life for an increasing number of people throughout the world, enriching society but also producing systems of such complexity that they create new dependencies and risks to society in the event of failures and service disruption. Since World War II, attacking infrastructure has been the primary way in which hostile countries seek to endanger national security and safety in their adversary nations, hence the need to invest in efforts aimed at defending against such risks (Orszag, 2003).

The 9/11 Commission, after a review of the magnitude of the attack and the resultant disruptions in infrastructural services, recommended the articulation of robust, co-ordinated actions to protect various modes of transportation. They also recommended that the allocation of federal assistance to state and local governments should be based on an assessment of risks associated with systems of infrastructure within their catchment areas (Moteff, 2005; Dowding, 2001). In doing so, Moteff (2005) stated that the Commission was reiterating existing federal policy regarding the protection of all the nation's critical infrastructures, in line with the Homeland

Security Act and other administration documents that assigned the Department of Homeland Security specific duties associated with coordinating the nation's efforts to protect critical infrastructure. This includes using a risk management approach to set priorities to reflect the changing dynamics of the challenges (Forest, 2006; Uhl, 2003; Steinzor, 2002; Whitehead and Aden, 2002).

According to Smith (2002), national infrastructures in America are so large, complex, and intertwined that understanding how they work, how they fail, and how best to protect them is a significant problem. He suggested modelling and simulation as one tool that could be used to explore these problems. He explained that simulation tools which capture the behaviours of the systems, the relationships within and between the systems and which possess some ability to measure the impacts of disrupting these systems are an essential part of any effective plan for protecting infrastructure systems. Rapid advances in infrastructure interconnectedness have created major challenges for protecting critical infrastructures, which today have become the lifeline of societies (Amin, 2009; Amin, 2007; Amin, 2005; Smith, 2002).

Infrastructures provide the wheel upon which the economies of nations around the world operate. Sudden attacks on them have always resulted in sudden disruptions in the flow of the services which they supply and this translates into a panic which affects society negatively (Bennett, 2007). This shows that if not protected and managed properly, infrastructure that is meant to serve society can become the source of serious service disruption and panic.

As Anderson said:

> *In today's global environment, national security is measured in both economic and military terms, and a nation's social advancement and world competitiveness relies upon efficient, robust and secure information systems, electrical power, transportation and other critical infrastructures* (Anderson, 2002, p.3).

A study of the infrastructure protection plan of Virginia shows a vast scheme that implements risk assessment and management methodologies across Virginia and its associated urban sprawl areas (Jones et al., 2003). One study, which reviewed growing national concern involving infrastructures that are so vital that their

incapacity or destruction would jeopardize the security of the United States, stressed the need to maintain a framework that anticipates and responds to the dynamics of changing challenges in the infrastructure management. The study highlighted errors and commonalities that could be utilised in the development of a more robust and more effective computer-based risk management tool.

Linear infrastructure presents unprecedented challenges to institutions charged with its management, as damage to any point affects the functioning of the whole system (Torbin, 2003; Roper, 2002). A number of advanced technologies have been developed to reduce the susceptibility of linear infrastructure to damage from natural and human causes. As reported by Roper (2002), the national transportation system in the United States is an example of a major part of the national infrastructure system for national growth and development that requires real-time protection.

The Global Positioning System (GPS) has been found to have the utility of combining with human agency for the monitoring of critical linear infrastructure (Roth and Schick, 2000). The adoption of GPS on its own presents certain limitations in the pursuit of quick and accurate solutions to terrain-related environmental problems. But when GPS is combined with human agency, changes are more apparent and can be subjected to real time spatial analyses in support of environmental and other management systems, involving facilities and activities that provide the essential services that support national economic wellbeing and overall quality of life (Little, 2004). According to Little (1999), linear infrastructure in the United States is central to the functioning of the national economy. Failure at any point along the chain will not only lead to disruptions in service delivery, it will also cause panic and confusion, which may last longer than the period of service failure.

Despite the very critical role public infrastructure plays in the national lives of countries, its management is still increasingly faced with challenges which, working through a collaborative framework, professionals in various fields could effectively resolve, in order to guarantee that services continue to be delivered for the overall good of the society (Roper, 2003; Roth and Schick, 2000).

Amin and Epri (2001) have reported that much of the infrastructure used for transportation, ranging from roads and railways to pipelines, is being faced with

issues of deregulation in many countries. This translates into responsibilities for the management of infrastructures being increasingly shared between public and private concerns. High quality and reliable services furnished through the infrastructure are fast becoming interdependent across national boundaries, so that failure in any one infrastructure will have a ripple effect on all others that share its interconnection and interdependence, making the challenges of collaboration between groups of stakeholders who are becoming polarised across the public/private sector divide even more daunting (Amin, 2005).

The increasing polarisation of stakeholders with roles in the management of infrastructures needs to be addressed if effective systemic solutions based on the needs of a particular community are to be developed; any framework must address these needs to effectively and efficiently share information across institutional boundaries within and between the groups that make up the community. In essence an interface must be specified at each boundary that separates levels in an agency to avoid conflicts amongst the collaborating stakeholders (Edelenbos, 1999). According to the proposal by Edelenbos (1999), management strategies for infrastructures should have technical, human and institutional components. The importance of these components is also proportional to the difficulty of implementing them in the context of a fragmented society with contending interests.

Infrastructures are large scale distributed systems that are highly interdependent, both physically and in their greater reliance on ancillary support infrastructure. They logically become vulnerable to exigencies external to them, in addition to the distinct possibility of deliberate sabotage (Warner et al., 2007). Vulnerability to sabotage of public and semi-public infrastructures caused the 9/11 incidents in the United States and the 7 July 2005 London sabotage incidents, deliberately targeted at the UK public transport infrastructure. The London incident resulted in the death and injury of scores of passengers and also created panic that reverberated long after the attack and compromised the integrity of the public transport infrastructure in the city (Rubin et al., 2005).

The Baku-Tbilisi-Ceyhan pipeline is said to be of primary importance to the nation of Georgia, both from the economic and political points of view (Papava, 2005). Implementation of the pipeline increased Georgia's economic strength. The nation

generated enormous revenue from the pipeline to fund its national budget and international financial commitments. Because of its geographical location, Georgia provides a transportation connection to Europe. For this reason, it became more economical to transport hydrocarbon resources and other commodities from Asia to Europe through Georgia, and this generated foreign exchange for the country and also promoted socio-economic activity throughout the state (Cornell et al., 2006). According to Bahgat (2006), the Baku-Tbilisi-Ceyhan pipeline in Georgia has become so important strategically for oil and gas transportation to Europe that the European Union has taken an interest in issues that have implications for its safety. This particular pipeline has not only provided the bastion of socio-economic growth and development for the nation state of Georgia, it has also provided a major economic link between Europe and Asia.

The transnational pipeline linking Argentina and Chile has promoted mutual interdependence between the two countries. The natural gas pipeline between the two countries has constituted a major project of large-scale investment for the two countries in a competitive international environment (Jadresic, 2000). According to Jadresic (2000), the transnational gas pipeline linking Argentina and Chile has promoted a competitive energy sector and free entry bi-national economy with important policy initiatives which have spurred cross-border investments, to the benefit of Chile's energy and environmental sector.

The gas pipeline has facilitated the supply of natural gas between the two countries in response to increasing demand for clean energy sources. This has also led to expanding investment in natural gas infrastructure between the two countries, setting the agenda for natural gas investment around the world. Apart from the Argentina-Chile natural pipeline project, many international projects now involve pipelines connecting energy markets in two or more countries (Beato and Fuente, 2000).

A key feature of the investment currently taking place in Latin America is the convergence of gas and electricity markets and the connectivity of nations through networks of pipelines. Many projects are being developed to supply gas to new power generation plants needed to meet electricity demands. Another significant project is the construction of the Argentina-Chile natural gas pipeline over the Andes Mountains, whose object is the supply of natural gas from Argentina to energy

markets in central Chile. This singular project is reputed to be the fulfilment of collaboration between the two countries that has been long-contemplated for political, economic, and technical reasons.

The Canadian-American trade in energy resources has also enhanced pipeline connectivity between the two countries (Greenwood, 2009). In Canada, trade in energy resources through the pipelines has become an important part of the national economy since oil and gas resources were discovered in commercial quantities. The oil produced was circulated for national consumption through the network of pipelines in the country. Oil and gas resources meant for export were transported through the pipeline network to the United States, which is the most important oil and gas trade partner of Canada (McDougall, 1991). The sale of Canadian oil and gas resources to the United States is a major source of the very much needed foreign exchange contribution to the national economy in the form of American dollars.

For its part, the American economy has benefited from the supply of oil and gas resources from Canada in terms of gaining a stable supply from a politically stable region of the world and this has greatly promoted international economic and governmental interactions between the two countries (Mason, 2008; Friedheim, 1986).

The industrialisation of the Chinese economy has been supported by the supply of the various derivatives of hydrocarbon resources from the Caspian region, Africa and other parts of the world (Barbasov, 2004). The larger part of the supplies from the Caspian region is transported through oil and gas pipelines. This has improved the relationship between government and business concerns in China with countries within the Caspian region.

It has been observed that China's quiet shift to net oil importer status in 1993 marked a forced departure from the Communist Party's three-decade experiment in self-sufficiency (Downs, 2004; Jaffe and Lewis, 2002). This creates the possibility that China may in the future become as vulnerable as other industrial nations to the vagaries of the global oil markets (Jaffe and Lewis, 2002). As the oil dependence of China increases, its drive to guarantee the supplies it gets through the networks of pipelines connecting it to the Caspian region might engender a more supportive

stance to western policies aimed at sustainability in oil supplies in the international oil market (Lee, 2005).

The problem of pipeline management has been shown to have global ramifications but manifests in ways that are distinctly deferent. This makes the Nigerian problems associated with the management of the over 5,000 Km of the pipelines and the associated ROW a unique. The account of pipeline failure in Nigeria has been that the environment has also suffered degradation. Human settlements have been affected and the people in the affected communities have lost properties and even loved ones to the fires that results owing to pipeline vandalism.

3.4 Susceptibility to sudden service disruptions

Vulnerability to sudden service disruptions due to deliberate sabotage and systems failure is one of today's major threats. Service disruptions negate the very essence of the huge investment of public and private concerns in the development of infrastructures. Service disruption is felt most when infrastructures that sustain the supply of basic services such as electricity and power are affected (Scaparra and Church, 2008; Phillips, 2005). Protecting the infrastructure network has enormous financial implications in terms of the aggregation of the appropriate materials and human resources to drive the process. Therefore appropriate cost-effective ways of allocating resources among the facilities of existing but vulnerable systems need to be worked out, in order to minimise the impact of the most disruptive events to unprotected facilities. This can be done with a view to developing a framework that provides for a collaborative role for stakeholders and has substantive and residual responsibilities for the management of either components, or the entire system, of infrastructure.

A system that integrates both the human element cutting across formal and informal sectors and a technical component, such as geographic information systems, using the utilities of the global positioning system to effectuate a continuous monitoring of the purlieus of a particular infrastructure or systems of infrastructures, would operate to guarantee the sustainability of the services that the systems produce for society (Scaparra and Church, 2008)..

A study of the evolution of the North American power grid over a period of about a hundred years shows that there has been a conscious awareness of how its operation output would behave under conditions of either deregulation, interaction with other infrastructures or in the event of a deliberate sabotage (Amin and Epri, 2001). Widespread supply disruptions in petroleum product distribution in Nigeria over the past 12 years has been reported to have raised public concern about the reliability of petroleum product haulage for national consumption (Onuoha, 2008b). This concern envisages the potential for larger, more frequent, supply disruptions due to sabotage and or non-human damages in the near future, arising from the absence of a management structure for the pipelines. Onuoha opined that an all-inclusive framework has the potential of transforming the most notorious vandal into an agent of protection against vandalism of the pipelines.

The reality of network failure due to deliberate acts that compromise the integrity of infrastructure portends greater risk to road and rail transportation, telecommunications lines, oil, water and gas pipelines infrastructures, because damage to any part of the chain will have a ripple effect on the entire loop and render the whole system incapable of service delivery for the duration of time before remedial measures are taken to repair the damaged portion of the infrastructure and service delivery is restored. The period of service disruption, no matter how short, causes panic in the immediate community and could even affect communities a long distance away from the points of origin of the disruptions.

The London public infrastructure attacks of 2005 represent the extent to which the sudden sabotage of public infrastructure could agitate society and move it in the direction of chaos and pandemonium. The incident, which was a coordinated terror attack on a number of public transport vehicles across the roads and rail networks, halted the movement of commuters and reverberated across the city of London to other nearby cities (Rubin et al., 2005). Not only did the incident result in revenue loss for the public transport system, it also caused unquantifiable losses in man hours, because many workers could not get to their places of work. The psychological cost of the incident was even more daunting, because the integrity of the public transportation system was greatly compromised in the eyes of its customers, a situation that took a considerable amount of time to ameliorate.

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3.5 Linear infrastructure as a distributed system

Linear infrastructure components are often dispersed over large areas of land, connecting places together. The infrastructure's individual components rely on a significant number of parameters that are human and technical, which must be subjected to independent control and monitoring within a component infrastructure sub-system, in addition to interdependencies with other infrastructure components within the larger system (Wolthusen, 2005). Monitoring the behaviour of the component sub-systems and interdependencies within the larger system for the identification of risks of failure can be performed using utility geographic information systems embedded in the framework of a coordinated community support system. This system provides a common semantic basis for presentation and analysis, as well as a mechanism for sharing only selected and, where necessary, downgraded information with other infrastructure operators, in order to identify and deal with any threat before it becomes a disaster (Warner et al., 2007).

3.6 ROW communities and oil wealth appropriation

Common-pool resources in the context of this research are pools of naturally occurring resources, such as petroleum deposits, fish ponds, forests, farmlands and clean air. The petroleum industry contributes over 80% of the gross national income in Nigeria. This research study found that in 2009 the oil and gas sector still contributed over 60% of the nationally collected revenue. This shows that petroleum resource is still nationally the most important natural resource in Nigeria. The crude form of the resource which is presently being exploited in the delta region is mostly refined in the same region and distributed through a network of pipelines to consumers across the country (Odoh and Iyi, 5005).

Distribution of this important national product for national use has been bedevilled by complaints of inequity. Administration of the associated national wealth accruing from the sale of the oil has also been described as inequitable (Brume, 2007). The pool of common resources that the oil and gas industry generates for national consumption in Nigeria, to the common good, has polarised society into a small privileged elite and an underprivileged majority who live on less than one American dollar a day (World Bank, 2004). These communities that exist along the pipeline

ROW in Nigeria are predominantly inhabited by groups of low income people whose means of livelihood, such as arable land, fish ponds and forest resources are constantly destroyed by oil spills and the resultant infernos.

Petroleum products in Nigeria are transported through communities most of which could only procure such products from the black market at exorbitant rates (Onuoha, 2008d). There is no national framework for management that integrates the role of the communities across the ROW, which measure over 7,000 km and traverse the whole length of the country (Akpan, 2006). Inequity in the distribution processes of petroleum products in Nigeria and the perennial inability of the ROW community members to access the products that they know are being transported through their villages have made communities exhibit inimical tendencies towards the pipelines and the oil companies (Onuoha, 2008a).

With a people who are uncomfortable about the pipelines and their accompanying ROW that run through their communities, and in the absence of any formal or informal arrangements to maintain surveillance over the pipeline, and where, furthermore, access to petroleum products is limited by a growing artificial scarcity, vandals have invaded the pipelines unchallenged, inflicting stress and psychological strain on the people.

This creates in the communities a sense of being abandoned by the government in the distribution of petroleum products and in the application of oil revenues for their social and economic benefit. When vandals occasionally invade the ROW to damage the pipeline in order to misappropriate the oil being pumped through it, they cause in the process a chain of social and environmental problems in the already impoverished ROW communities. These are communities that already lack basic infrastructure and services such as roads, potable water and electricity with which they could have fulfilled their cultural, spiritual and material needs in equitable ways. In addition, due to the actions of the vandals, they now have to content with oil spill and the incessant vandalism and intimidation. Thus, having suffered inequity from the neglect of the authorities, the multinational oil companies and, lately, the vandals, community members have lost faith in due process and have become

vulnerable to the extent that, at the risk of bodily harm or even death, the helpless commons in the pipeline communities still attempt to scavenge from the spoils of oil in the wake of vandalism (Onuoha, 2008d). Because the community members that are spatially close to the pipelines are not included in the management of the ROW, vandalism has continued unabated.

3.6.1 Linear infrastructure: the target of vandalism

Threats and vulnerability to terrorist attacks have become leading issues of uncertainty confronting managers of linear infrastructure, such as oil and gas pipelines, roads and electricity lines in the kingdom of Bahrain (Hamza, 2002). Comprehensive national efforts rooted in research have led to the institutionalisation of a national infrastructure management plan that encompasses disaster mitigation, emergency preparedness and response and disaster recovery services that rise to the occasion as and when the need occurs (Hamza, 2002). The ubiquitous nature of energy infrastructures, such as petroleum pipelines and electricity lines and their associated ROW make them convenient targets for terrorism, resulting in service disruption and other unquantifiable damages to the environment (Jenkins, 2006; Smith, 2002).

Energy infrastructure in the United States and other parts of the world consists of miles of intricate networks, such as overhead electric transmission lines and underground oil and natural gas pipelines (Torbin, 2003). The infrastructures are constructed of simple and easily repaired hardware, so that reported cases of breakdown can be easily sorted out. However, the ubiquitous nature of the hardware also makes it a convenient target for terrorism. A disruption in service has the same impact on the users regardless of whether the cause is natural or man-made. Similarly, response to distress-caused service disruptions due to infrastructure failure is the same regardless of the initiating event. Unfortunately, the loss of service is usually long-term and does have a national impact, estimated at billions of US dollars (Moteff, 2005; Torbin, 2003).

Because of the ubiquitous nature of infrastructure and the growing threats of terror attacks, efforts at developing a sustainable management plan must be focused on directing attention to the creation of real-time monitoring of the networks to insulate

them from attacks and to shorten response time in the event of attacks, rather than focusing on the present reactive approach, which is ineffective for preventing or mitigating an attack. Present global practice is not based on research-based forecasts of threats to service breakdown and so does not provide for programmes aimed at building community resilience to the negative eventualities that underpin abrupt service disruptions due to infrastructure attacks (Torbin, 2003; Little, 1999).

Infrastructures are often discussed in terms of hardware such as pipelines, roads and electricity lines, but it is the service which they produce that is of real value to the society. Discourse on infrastructure should encompass institutions and people, in addition to technological artefacts (Amin, 2005). Infrastructures are only viable if they are supported by organisational and social systems that would operate to protect and maintain them within the increasingly socially fragmented and environmentally diverse spatial contexts in which they exist (Little, 2004; Federal Environmental Protection Agency, 1991).

Heavy infrastructure, like oil and gas pipes and electricity lines, are essentially socio-technical systems according to Little (2004). They consist of an assemblage of technological artefacts, human elements and organisational frameworks and procedures that combine to deliver a product, service or a public good. While the relative importance of the components of the overall system may vary, all must function to achieve the effectiveness of the system for optimal service delivery. In the operations around the ROW in Nigeria, the technological artefact, which consists in the pipeline, has not been aligned with the human element and the institutional framework in order to create a ROW management system that engenders the collaborative support of host community stakeholders (Lukasik et al., 1998).

The involvement of community based non-governmental organisations in the management of the environment and public infrastructure, like oil and gas pipelines and roads, has made a substantial contribution to improvements in environmental management in Russia (Wernstedt, 2002). It afforded a public-private coalition for building consensus towards the monitoring and maintenance of public and semi-public infrastructures. The arrangement afforded the opportunity for a periodic review of contending issues that informs policy decisions on management of environmental issues relating to public infrastructures. When activated, this kind of

public–private collaborative framework, complemented by geographic information systems, would make virtual monitoring a possibility. This also holds the potential for providing an alternative concept for resolving spatial environmental challenges like the crisis the petroleum pipelines ROW presently face in Nigeria.

3.6.2 Vandalism and resilience in ROW communities

Disaster situations can be conceptualised based on measures of traumatic stress behaviour, intrusive thoughts, or other symptoms of the subconscious processing discordant information following a traumatic experience in a community (Comfort et al., 2001). Building disaster preparedness entails the creation of critical awareness about potential hazard situations in communities as a way of preparing members for eventualities that may operate to distort the normal course of community activities. A role for critical awareness in communities may be particularly important given the rarity of natural hazard activity in some parts of the world and the realisation that, in contemporary society, people also face adversity from natural hazards, such as terrorist activities, unemployment, crime and deliberate acts of sabotage (Norris et al., 2008).

Community resilience is the extent to which the people are prepared to cope in a disaster situation (Paton, 2003). Building capacities for resilience in a community therefore entails helping the members to be aware of, take action in regard to, and also prepare for, hazard events that may occur. This will increase individual and community-wide abilities to plan for, and recover from, hazard situations to which communities may be prone. These awaken people's consciousness of the need to constantly review their state of preparedness and the extent to which they think they are able to cope in the event of hazards in their environment. Research into how community members respond to adverse circumstances has identified critical awareness as an important precursor in building resilience in communities (Finnis, 2004).

In some societies, the threat of hazard is from natural phenomena such as volcanoes, earthquake or tsunamis, while in others, the threat relates to man-made activities such as terrorist attacks, suicide bombings and acts of vandalism against public infrastructures (Tobin and Whiteford, 2002). Irrespective of the cause of hazardous

activities, the effects on society have always been the same, manifesting in the breakdown of the normal course of activities, apprehension, chaos and strains upon people's resolve to continue their normal course of business. In Nigeria, there are few disasters owing to natural phenomena. Prominent in the list of man-made disasters in Nigeria is the problem of pipeline vandalism (Onuoha, 2008c).

The problem of vandalism pervades the ROW of pipelines across the geographic landscape of the country. The communities along the ROW have suffered from incessant acts of pipeline vandalism. Some farming and fishing communities have lost arable lands and fishing ponds due to contamination caused by oil spill occasioned through vandalism. The impact of vandalism in these communities transcends the initial shock suffered when vandalised pipelines explode, causing infernos which on some occasions have razed substantial portions of communities, destroying valuables and in some extreme cases causing death; they also suffer greater long term effects of loss of means of livelihood. Post-vandalism trauma in the wake of spilled petroleum products has long term reverberations, because it may take months before the attention of the authorities is drawn to the scene.

Remedial measures are often promised by multinational oil companies and the government, but never executed. Most explosions caused through vandalism saw the subsequent inferno continuing to burn until the fuel already pumped in the damaged pipe was exhausted (Onuoha, 2008e). This has often left communities in distress and unable to cope over a long period of time. How well a people in a distressing situation cope through the uncertainties imposed by disaster will depend on the extent of information they possess about disaster events, and may be due to the level of resilience education about the potential sources of particular hazards the community is prone to (Tierney et al., 2001).

Research has shown that city-specific disasters have proved to be more onerous to administer (Godschalk, 2003). This is because the build-up of city fabrics is composed of an intricate network of interdependent systems that are extremely vulnerable to threats from both natural hazards and terrorist activities. The pipeline disaster of 2008 in Lagos, Nigeria (Clement-Ogbuanu, 2008), presented a hazard management challenge that overwhelmed a densely populated city. The disaster resulted in an inferno that razed public and private properties uncontrollably along its

course. Emergency services were stretched to the limit and yet the sprawling disaster was not contained. The absence of a comprehensive strategy of urban hazard mitigation has been brought to the fore in the Lagos and other pipeline disaster incidences in Nigeria over the years (Odoh and Iyi, 5005). This underscores the need to build resilience capacities across the cities and rural areas traversed by the pipelines to enable them to demonstrate community resilience in the face of the vandal-orchestrated disaster which so easily besets them. The absence of resilience capacities has led to communities along the ROW being unable to cope with the slightest situation of disruption caused by acts of vandalism.

The state, through its emergency services, has also exhibited incapacity in dealing with the chaotic reactions that trail pipeline vandalism in Nigeria (Aprioku, 2003). Building resilience capacity in communities is important because the same principles can be applied in resolving the negative externalities of vandalism that impose straining conditions on the physical and social fabrics of cities, making the people react in an erratic manner in the face of vandalism and oil spill.

Vandalism and its associated spill is only noticed by the appropriate authorities days after the pipeline host communities have suffered losses in amenity, environmental assets and valuable farmlands and fish ponds (Chokor, 1993; Ikporukpo, 1986). The present arrangement has failed to deal with the unique hazard challenges which pipeline communities in Nigeria face, hence the need for a major resilient capacity-building initiative, including expanded ROW for community systems research, education and training, and increased collaboration among professional groups involved in agitating for pipeline hazard mitigation.

Public/ private collaboration has traditionally been viewed as a partnership or as a contractual interaction between government agencies and private sector companies (Stewart et al., 2009). Across all of the aforementioned disasters, some private sector firms have responded as part of a government contract, while others responded because they have vested interests in the impact area through physical assets, suppliers, customers and corporate values of social responsibility. There is a need to expand the remit of public-private initiatives in disaster management in Nigeria to include other types of interaction which may provide flexibility. There is also a need to enable participating firms to adapt relationships to effectively address response

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and recovery issues that emerge in the aftermath of a disaster in the ROW communities, as these expose the largely very poor commons to different situations of jeopardy.

3.6.3 Economic incentives as options for management

Economic incentives can be used as an option for the management and protection of public infrastructures that create environmental problems. In the United States, economic incentives are used to enlist the cooperation of the communities located close to major infrastructural facilities that impact on the environment (Federal Environmental Protection Agency, 1991).

A task force approach was used to mobilise the support of local people, who then received a token economic incentive in return for implementing a programme designed with local inputs for the management of critical environmental issues which were perturbing the operation of massive critical state-owned infrastructure. This approach recorded tremendous successes because the participants saw themselves as stakeholders and felt rewarded by the token economic incentives handed out to them (Tripp and Te Velde, 2006; Federal Environmental Protection Agency, 1991).

The option of economic incentives was meant to influence rather than dictate action in the task of environmental management and infrastructural protection. This option of incentives could form part of a broad-based management plan for publicly held infrastructures like the ROW of pipelines. This provides for positive engagement of criminal elements in pipeline host communities in order to influence them towards positive involvement in the protection of the unprotected ROW. This will also propel corporate organisations, both public and private, to evolve corporate responsibility programmes that will nudge the host communities towards becoming protective of the ROW of petroleum pipelines.

According to Phillips (2005), infrastructural surveillance must entail every day, taken-for-granted, institutionalised and technically mediated practices which will identify, observe and analyse individual actions in relation to the management of public infrastructure within a socio-technical framework that is capable of reporting

system failures for appropriate response. This initiative recognises the potential of the specific geographic knowledge located in the communities that are in the vicinity of the pipelines and the difficult environmental and social challenges these people face in the event of pipeline vandalism. Vandalism causes oil spill that directly contaminates the farmland and fishing ponds of the agrarian communities.

In most of the communities, pipelines traverse terrain that is institutionally fragmented among different communities. The communities exhibit different cultural traits that inform their disposition towards the pipelines, but over the years the ROW have forged a bond of unity across these communities, due to their shared experience of the negative externalities of the pipelines (Pinto et al., 2003; Roche and Humeau, 1999). The communities, in spite of cultural differences, have identified the pipelines as a common plague that troubles human settlements across the pipeline ROW with negative externalities, such as contamination of their water and land and also occasional infernos that always leave communities counting losses in their wake (Brewer et al., 2000; Jones et al., 1997).

Spatial collaboration for linear infrastructural management can be achieved through the medium of real-time, map-based geographic information systems (Kyem, 2000; Klosterman, 1999).

3.7 Chapter Summary

This chapter has shown that the challenges in the management of linear infrastructures manifest differently across national boundaries and application of the participatory utility of the GIS could engender a collaborative process that integrates the stakeholders. It is increasingly becoming an acceptable practice to integrate environmental and social sustainability demands into the way companies and governments relate with the host communities that suffer the consequences of their actions, in order to achieve and maintain the societal patronage that is crucial for business profitability, environmental justice and social equity in the long-term. Society is understood as a system with group stakeholders who could be public, corporate, civil society or community based, each pursuing a concrete mission. Thus, because of the exclusive purpose of wealth creation and return of investment in

corporate organisations both public and private operating in a free market, it is possible for them to abdicate their fiduciary duty to the society wherein they operate.

Furthermore, this chapter has explained the challenges in the management of linear infrastructure, particularly petroleum pipelines, in a global context. It reveals that the problem of pipeline management is essentially a global one that manifests in various ways within national and regional boundaries.

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CHAPTER 4

RESEARCH CONTEXT

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CHAPTER 4

RESEARCH CONTEXT

4.1 Introduction

In chapters two and three, existing literature on corporate social responsibility, collaborative planning, geographic information systems and linear infrastructure management challenges from a global perspective were reviewed. Building upon the research gap identified, the aim and objectives for this enquiry were developed. In order to achieve the research aim and objectives, the need arose for a succinct description of the research context and the contextualisation of a reliable approach through which the research questions might be answered. In order to do this, this chapter presents a succinct account of the pipelines used in transporting petroleum products in Nigeria, together with their associated ROW.

Nigeria has been described as the African nation with the largest population (Adepoju, 2003; Bilsborrow and Ogendo, 1992). The country is also the largest of the West African states in terms of land area. Nigeria was an early 20th century British colony that became an independent nation in 1960 (Falola and Heaton, 2008). It is a country of great diversity because of the many ethnic, linguistic, and religious groups that live within its borders. Nigeria is also a country with a long socio-cultural and political history. The history of the peoples who constitute the present state dates back more than 2,000 years (Falola and Heaton, 2008). The earliest archaeological finds are of a people, the Nok[5], who inhabited the central Jos Plateau between the Niger and Benue rivers between 300 B.C. and 200 A.D. A number of states or kingdoms with which contemporary ethnic groups can be identified existed before 1500. Of these, the three dominant regional groups were the Hausa in the northern kingdoms of the savannah, the Yoruba in the west, and the Igbo in the south eastern part of the country (Ibrahim, 2008; Ekundare, 1973).

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[5] The Nok ethnic group were among the earliest settlers of the present geographic entity called Nigeria.

4.2 The geography

Nigeria is geographically located within the West African region, bordering the Gulf of Guinea, between the Benin Republic and Cameroon. The country is located at 10 00 N and 8 00 E and has a total area of 923,768 sq km, out of which land constitutes 910, 768 sq km and water 13, 000 sq km. Land boundaries measure in total: 4,047 km. The border countries and their associated land boundaries are: Benin 773 km, Cameroon 1,690 km, Chad 87 km, Niger 1,497 km. The coastline which runs along the Niger Delta region measures 853 km. The Nigerian coastline is rich in oil and gas deposits, the exploration of which resulted in the discovery of oil in commercial quantities in 1956. This development brought about the need to lay pipelines for evacuating the crude oil to export terminals for export.

4.3 Geographic and political zones

Nigeria is divided into 36 sub-national administrative and political units called states and a federal capital territory from which the country is centrally administered. The 36 states and the federal capital territory are further classified into six zones called the geo-political zones of the country. These zones are evenly spread across the north- south division of the country. Three are spread across the northern zone and three are in the southern zone of the country. The zone in the south-western part of the country is made up of the following states: Lagos, Ondo, Ogun, Osun, Ekiti and Oyo.

The south geo-political zone is comprised of Bayelsa, Delta, Edo, Cross River, Akwa Ibom and River States. The south east geo-political zone is made up of Anambra, Enugu, Abia, Ebonyi and Imo States. In the northern part of the country, the zones are the north central, consisting of: Benue, Niger, Kwara, Plateau, Nasasrawa and Kogi States. The federal capital territory is also located in the north central region of the country. The north eastern zone of the country is comprised of Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe States. The north western zone is made up of Kano, Kaduna, Katsina, Kebbi, Sokoto and Zamfara States. The pipelines are evenly spread across the country from the south to the north.

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The Federal Capital Territory is statutorily headed by the president of the country, who usually delegates administration to the cabinet minister appointed by him. The states in Nigeria are presided over by a governor, the chief executive. These governors, who also double as the chief security officers of their respective states, have no constitutional powers to manage the pipelines' ROW because the powers devolved to them fall within the residual list in the 1999 Nigerian constitution, which does not include powers over pipeline management (National Assembly Nigeria, 1999).
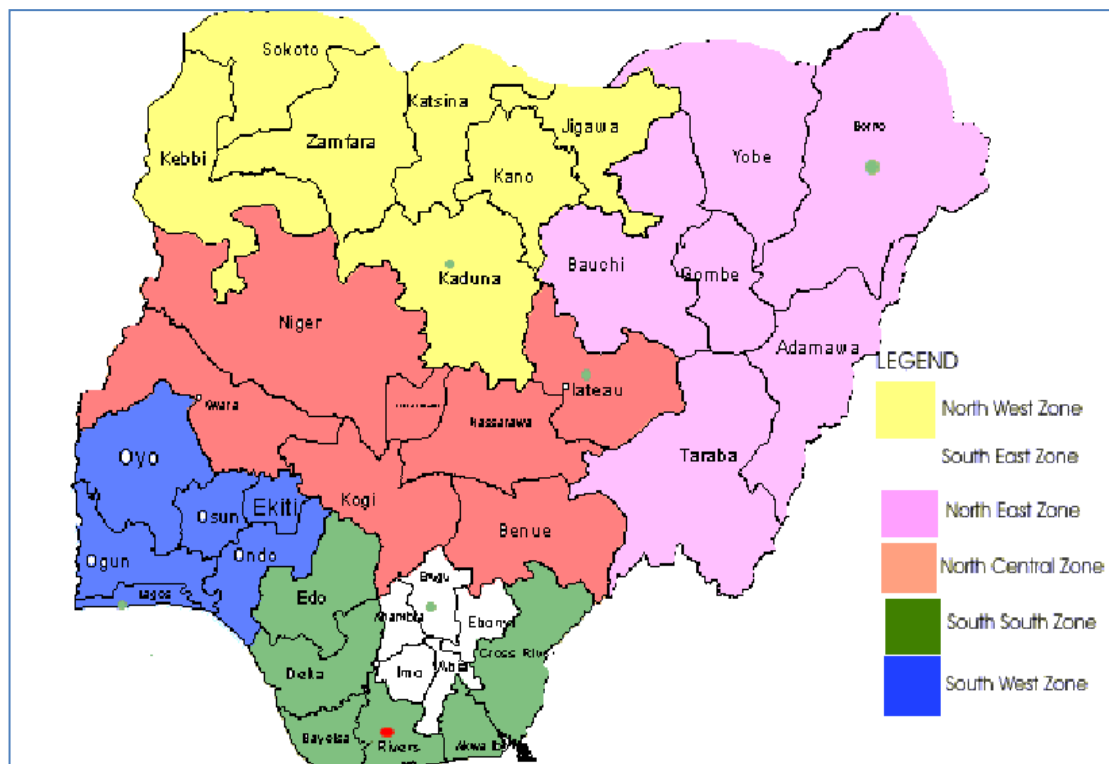
Figure 3: Map showing Nigeria's states and Geo-political Zones

Source: Atlas of Electoral Constituencies in Nigeria 2008.

4.4 Climate and vegetation

As in most of West Africa, Nigeria's climate is characterised by strong latitudinal zones, becoming progressively drier as one moves north from the coast. Rainfall is the key climatic variable, and there is a marked alternation of wet and dry seasons in most areas. Two air masses control rainfall: moist northward-moving maritime air coming from the Atlantic Ocean and dry continental air coming south from the

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African landmass. Topographic relief plays a significant role in local climate only around the Jos Plateau and along the eastern border highlands.

In the coastal and south eastern portions of Nigeria, the rainy season usually begins in February or March as moist Atlantic air, known as the southwest monsoon, invades the country. The beginning of the rains is usually marked by the incidence of high winds and heavy but scattered squalls. The scattered quality of this storm rainfall is especially noticeable in the north in dry years, when rain may be abundant in some small areas while other contiguous places are completely dry. By April or early May in most years, the rainy season is under way throughout most of the area south of the Niger and Benue river valleys.

Farther north, it is usually June or July before the rains really commence. The peak of the rainy season occurs through most of northern Nigeria in August, when air from the Atlantic covers the entire country. In southern regions, this period marks the August dip in precipitation. Although rarely completely dry, this dip in rainfall, which is especially marked in the southwest, can be useful agriculturally, because it allows a brief dry period for grain harvesting.

From September through November, the north east trade winds generally bring a season of clear skies, moderate temperatures, and lower humidity for most of the country. From December through February, however, the north east trade winds blow strongly and often bring with them a load of fine dust from the Sahara. These dust-laden winds, known locally as the harmattan,[6] often appear as a dense fog and cover everything with a layer of fine particles. The harmattan is more common in the north but affects the entire country except for a narrow strip along the southwest coast. An occasional strong harmattan, however, can sweep as far south as Lagos, providing relief from high humidity in the capital and pushing clouds of dust out to sea.

The regularity of drought periods has been among the most notable aspects of Nigerian climate in recent years, particularly in the drier regions in the north. Experts regard the 20th century as having been among the driest periods of the last several

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[6] Harmattan is a seasonal weather situation characterised by dry cold wind, low visibility and dust haze in Nigeria.

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centuries; the well publicised droughts of the 1970s and 1980s were only the latest of several significant episodes to affect West Africa in this century. At least two of these droughts have severely affected large areas of northern Nigeria and the Sahel region farther north. These drought periods are indications of the great variability of climate across tropical Africa, the most serious effects of which are usually felt at the drier margins of agricultural zones or in the regions occupied primarily by pastoral groups.

Temperatures throughout Nigeria are generally high; diurnal variations are more pronounced than seasonal ones. The highest temperatures occur during the dry season; rains moderate afternoon highs during the wet season. Average highs and lows for Lagos are 31° C and 23° C in January and 28° C and 23° C in June. Although average temperatures vary little from coastal to inland areas, inland areas, especially in the north east, have greater extremes. There, temperatures reach as high as 44° C before the onset of the rains or drop as low as 6° C during an intrusion of cool air from the north from December to February.

The vagaries of climatic conditions across the country mean that the pipelines network is subjected to different weather and climatic conditions. The associated ROW also varies in vegetation from the north to the south of the country. The difference in vegetation has given rise to different land uses across the country, and this in turn has resulted in different ethnic groups locating along the pipelines all across the country.

4.5 Oil and the national question in Nigeria

Oil, which was discovered in 1956, played an important role in the formation of the first post-independence government in Nigeria which operated a constitutional parliamentary system (Ibaba, 2011; Sklar, 1965). Under this system, the regional governments controlled the resources generated from their respective regions but paid tax to the federal (central government), which had constitutional responsibility for the maintenance of core national services and infrastructures, such as national defence and the federal transportation system. Unequal taxes were paid by the regional governments to the central government under this arrangement. The resources accruing from the regions to the national treasury were then distributed on the basis of demographic and spatial indices (Smith, 2004).

The unequal north-south divide which the 1914 amalgamation of the country produced resulted in a situation where taxes collected from the regions at national level were unequally appropriated for developmental activities across the country (Sala-i-Martin and Subramanian, 2003). Based on the indices used at that time for the distribution of resources nationally, the relative size of the northern region in terms of population and spatial extent gave it an advantage, but in parallel, disadvantaged the southern region. The relative advantage of the north region in terms of population and land mass also gave it a representational advantage in the national parliament with the consequence that appropriation of national resources was further tilted in its favour (Oyefusi, 2007b). This perceived overall inequity in power relations between the north and the southern regions, and particularly between constituent regions within each, led to agitations which took on various manifestations in post independence Nigeria.

4.6 Post-independence struggle for oil wealth control in Nigeria

The disparate north-south representation in parliament produced a power relation imbalance that gave the northern region of the country an absolute majority, with the result that it controlled the polity to its advantage (Osha, 2006). This created a situation of mutual suspicion and perceived inequity in the distribution of resources and opportunities from the centre (Etemike, 2009). A result of this perceived and manifest control of the national polity by the northern region was the emergence of various movements for a redefinition of the concept of the Nigerian nation from the standpoint of oil politics.

4.6.1 The Niger Delta uprising of 1966

The representational north-south dichotomy in post-independence Nigeria and the perceived inequity it produced came to a head in the Niger Delta uprising of 1966 (Osaghae, 1995). The uprising, which culminated in the emergence of a separatist movement, essentially protested the national arrangement that gave control to the north (Nwajiaku-Dahou, 2010). The movement unilaterally declared a short-lived sovereign Niger Delta Republic, which lasted for a few months before it was crushed by the Nigerian National Army (Onduku, 2001).

The reason for the revolt lay in the struggle for the control of the proceeds of crude oil sales at the time (Saliu et al., 2010). Over 90% of the daily output of oil and gas produced in the country is derived from the Niger Delta region meaning that its net input into Nigeria's annual national budget has been estimated as a proportion of over 75% on the average (Budina and van Wijnbergen, 2008). However because of its relative demographic disadvantage compared to the northern region, the Niger Delta region only had, and still has, a degree of representation that makes its political influence at the federal level (where decisions are made as to the management of the national revenues) near inconsequential, even though the bulk of revenue is derived from that region.

The revolt which was led by Isaac Adaka Boro[7] accused the northern Nigeria-dominated central government of oppression and outright usurpation of the oil wealth of the south, to the latter's economic and developmental detriment, and particularly that of the Niger Delta, which had to grapple with the negative environmental and other consequences of oil exploration in the region. Though the violent manifestations of the uprising were crushed, this did not end the quest for greater control of the proceeds of oil, the bulk of which is produced in the area. The effect of the defeat of the Boro-led revolt was the consolidation of the political strength of the northern region within the body politic of the country and a realignment of the struggle for complete control of the revenue generated from oil resources under the auspices of the Biafra Front. This Front, in which Isaac Adaka Boro played an important role, prosecuted a secessionist civil war that lasted for 30 calendar months, before culminating in failure (Stremlau, 1977).

4.6.2 Oil and the Nigerian civil war

Another protest against the post-independence power relations in Nigeria which tilted domination of the national polity to the northern part of the country was realised in the 1967 attempt of the south eastern region of the country to secede, in the form of the (now disbanded) Republic of Biafra (Nnaemeka, 1997; Nayar, 1975). The resultant war, which lasted for about three years, ended with a further strengthening of the northern political establishment in relation to its southern counterpart (Watts, 2004; Stremlau, 1977).

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[7] Isaac Adaka Boro was the leader of the first oil related separatist movement in Nigeria

At the heart of the Nigerian civil war was the quest for political control of the proceeds of oil, as well as the network of pipelines and other infrastructures that were used for its production, refining and transportation for domestic consumption nationally and internationally for export (Obi, 2010). The defeat of the 1967 civil war again resulted in further strengthening of the northern political establishments' influence over inter-regional power relations within the country (Nolte, 2002; Ejobowah, 2000; Saro-Wiwa, 1989).

As result of the crushing defeat of the civil war and the Boro-led uprising, Nigeria altered its system of government, from the post-independence constitutional parliamentary system, into a new federal system. The net effect of the transformation was the concentration of political power in the hands of central government and the complete subjugation of the regional authorities to the federal government. Under the new arrangement, central government became the beneficiary of the revenues that accrued from the oil and gas sector, with the consequence that the northern establishment-controlled federal government usurped the power of the regional governments over collecting revenues for natural resources within their respective territories. This development further strengthened central government and also placed the northern political establishment in a more advantageous position with regard to the exercise of legitimate influence over the way the oil wealth of the country is managed (Obi, 2007b).

The struggle for equity in the control of the nation's oil establishment by the oil producing minority communities transformed from an outright separatist struggle into a movement for greater influence over the management of the proceeds of oil in in the Nigeria of the mid 1970s, called the "Resource Control Struggle"[8] (Ikelegbe, 2006b; Watts, 2004).

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[8] Resource control connotes a civil approach to the demand that the Niger Delta region of Nigeria should have more control over the oil and gas resources that are exploited from the area.

4.6.3 Resource control struggle in Nigeria

The resource control phenomenon started as a non-violent agitation by the Niger Delta elites for greater participation in the exploration, appropriation and management of the economic opportunities and activities which the oil and gas industry generated (Ikelegbe, 2006b; Ifeka, 2001). The resource control struggle initially maintained a peaceful intellectual outlook under the new-found leadership of Ken Saro-Wiwa through the 1980s to the mid 1990s, before becoming violent again (Omotola, 2009; Ibeanu, 2000). The violent phase of the resource control struggle started in 1995, after the leader of the resource control campaign was successfully prosecuted for an alleged crime against the Niger Delta people, for whom he had advocated environmental justice, equity and a voice in the national polity of Nigeria (Watts, 2008a).

The execution of Saro-Wiwa and other leaders of the resource control struggle was, according to Boele *et al.*, (2001), the spark that undermined the intellectual and activist stance of the resource control struggle. Five years on, the violent nature of the struggle had taken a cynical turn and different groups took up arms with the sole ambition of pushing the government and the oil companies to accede to the region's demand for a greater share of the wealth generated from the Niger Delta oil resources (Onduku, 2001). The struggle came to recognise the northern political establishment, the oil companies and the Nigerian state as the actors behind the decade-long deprivation of the ethnic minorities in the Niger Delta Region of their legitimate claim on the nation's oil wealth (Dibua, 2005). The violent phase of the resource control struggle initially suffered high handed repression by the Nigerian state and the oil companies. This action of state violence against the protest resulted in the extension of the activities of the activists to hostage-taking for ransom and a marked escalation in pipeline vandalism (Oyefusi, 2007b).

The escalating problems culminated in a near halt of crude oil production activities in 1999. Production dropped sharply from over 2 million barrels per day to less than 0.4 million barrels per day (Watts, 2008b; Obi, 2007b). As Watts (2008b) puts it:

> *The turn toward violence was in evidence of course in the ways in which the Ogoni Movement under the leadership of Ken Saro-Wiwa was brutally*

repressed by the Nigerian state in the 1990s. There has been a very substantial escalation of violence across the delta oil fields, accompanied by major attacks on oil facilities and civil violence among and between oil producing communities and the state security forces is endemic (it is estimated that more than one thousand people die each year from oil-related violence). The tactics and repertoires deployed against the companies have been various: demonstrations and blockades against oil facilities; occupations of flow stations and platforms; sabotage of pipelines; oil "bunkering," or theft (from hot-tapping fuel lines to large-scale appropriation of crude from flow stations); litigation against the companies; hostage taking; and strikes. (Watts2008b:6).

The result of the state-orchestrated violence was to add a further complication to the problem of vandalism in the area, with a marked involvement of robber barons of non-Nigerian origin, who provided arms and other logistical supports that the activists used to compromise the pipelines and to effect theft oil crude oil from the creeks (Mähler, 2010).
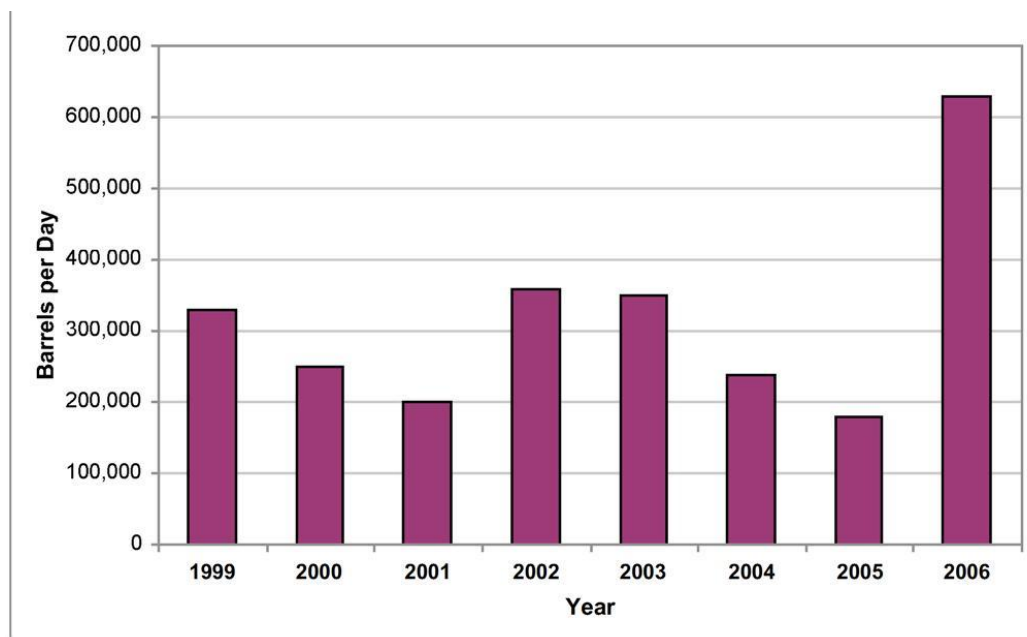
Figure 4: Vagaries in crude oil production owing to vandalism (1999_2006)

Source: www.legaloil.com

As shown in the figure above, the problem of vandalism continued and by the year 2005, the already critical situation worsened, with a further drop in the production of crude oil to less than 0.2 million barrels per day. The sharp fall in production at the time impacted negatively on the national revenue of Nigeria and also affected the global oil supply (Watts, 2008a; Osaghae et al., 2007). The violent struggle,

however, did not change the power relationship between the north and south of the country, but it did constrain the central government to grant an avalanche resource for the physical development of the region and an amnesty programme that persuaded the armed wing of the resource control struggle renounce violence in exchange for the opportunity to gain training and employment in the oil and gas industry (Asuni, 2009). The net effect of the amnesty programme has been a reduction in the number of attacks on the pipelines, particularly in the Niger Delta region and the associated rise in the production of crude oil to well over 2 million barrels in the last quarter of 2010 (Obi, 2010).

4.6.4 Politics of oil infrastructure distribution

Distribution of pipelines and other oil infrastructures is fairly even spread across Nigeria (Daukoru, 2004).
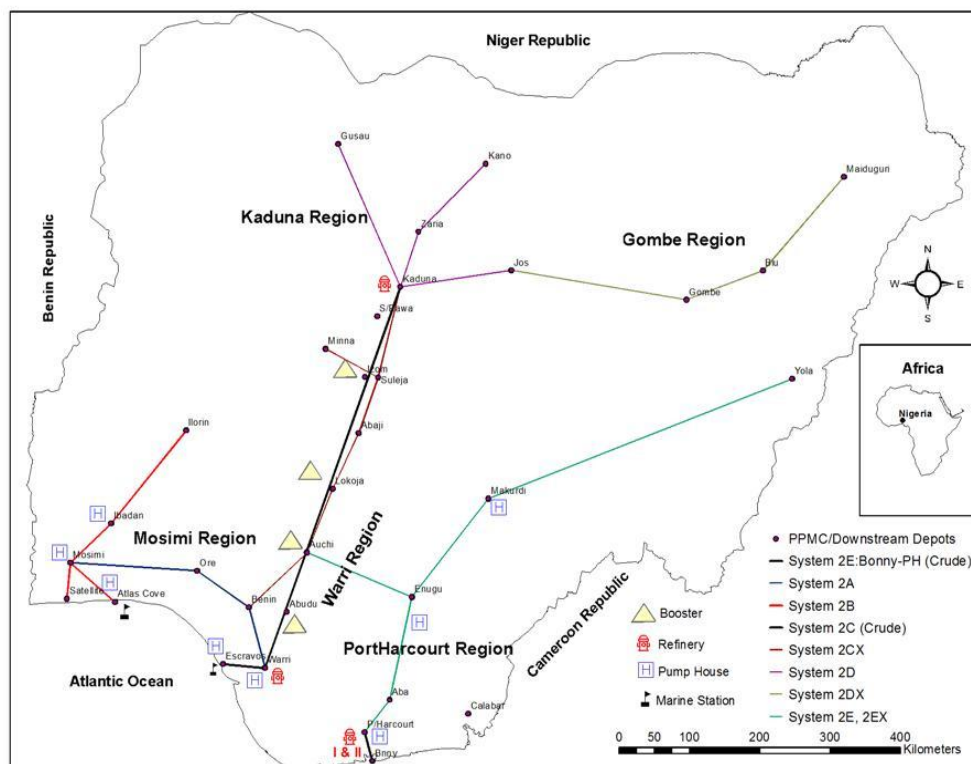
Figure 5: Systems of pipeline network inland distribution depots in Nigeria

Source: Fagbeja 2008.

The location of a refinery in the northern regional of Kaduna, as shown in figure 5, has been interpreted as a having a political aspect that underpins the power relations

in the country (Akpabio and Akpan, 2010; Lawal, 2005). The activists in the Niger delta region argue that only a hollow economic logic could support the location of a refinery so far away from the zone from where crude oil is produced. Apart from the refinery in Kaduna, another has been proposed in Lokoja, also in the northern region, which can be read as another reflection of the power imbalance that operates to locate more oil infrastructures away from the Niger Delta in the south, where crude oil is produced. The distribution of the pipelines and other oil and gas infrastructures is discussed in section 4.8.

4.7 Four decades of state control of oil in Nigeria: 1970-2010

At the end of the civil war that resulted from the contestations of the regional political leaders, General Gowon led the country and achieved an impressive degree of reconciliation. The long period of civil war, which lasted from 1967-70, accounted for the greatest setback in the country's efforts at infrastructure development, even though it was fought for reasons of infrastructural exigency. However, the subsequent reconciliation brought about a boost in exploration and exploitation activities which generated an unprecedented amount of wealth for the country (Bird, 2002; Watts, 1999). As a result of the boom in oil production, Nigeria became one of the wealthiest countries in Africa, with surplus budgets recurring yearly. The surplus earnings were committed to elaborate infrastructural development. At this time, oil pipeline development recorded its highest-ever boost across the country.

The engagement of the government in pipeline development continued throughout the 1970s and the 1980s, without any in-built plan to manage the associated ROW which the pipeline and the Nigerian national petroleum corporation acts created (National Assembly Nigeria, 1990d; National Assembly Nigeria, 1990c). The economic fortunes of the country changed when the price of oil in the international oil market plummeted, halting the ambitious pipeline expansion project and constraining the central government's ventures into funding activities that would have alerted the state governments to the congealing crises that were now manifest in the form of pipeline vandalism and other socio-economic problems.

Neither the brief periods of civilian government nor the frequent bouts of military intervention proved able to rescue the situation. A regular response was to subdivide regional Nigeria into ever-smaller parcels. The number of states was increased to 19 in 1979 and to 29 in 1991. By the end of the century it stood at 36, creating more regional centres and promoting physical development, which at the time was financed mostly through loans from external sources. As a result, the nation's foreign debt has been increasing in parallel, to reach $36 billion by 1994 (Reinhart and Rogoff, 2010; Ikejiaku, 2009; Budina et al., 2008).

4.8 The Nigerian petroleum pipeline in history

The development of oil and gas pipelines in Nigeria started with the discovery of oil in commercial quantities oil in 1956 at Oloibiri in the Eastern Niger Delta region after half a century of exploration activities. The discovery was made by Shell-D'Arcy (later changing its name to Shell BP), which was a joint venture between the Shell Royal Oil Company and British Petroleum. At the time, this company was the sole concessionary of oil and gas exploration over the whole of the territory of Nigeria (NNPC, 2002). Pioneer production began in 1958, with foreign multinational oil companies spearheading the building of Nigeria's national oil and gas infrastructure, including the pipelines which they solely owned as well. The average daily production from the Oloibiri Oil field was estimated at 5,100 barrels (NNPC, 2002). Further expansion in the pipeline occurred in 1960 when exploration rights in onshore and offshore areas adjoining the Niger Delta were extended to other foreign companies. In 1965, another oil field was discovered by Shell in the shallow water southeast of Warri, and soon afterwards, pipeline was extended to this oil field.

Major events in the history of the Nigerian Oil and Gas industry date back to 1908, when the Nigerian Bitumen Company Limited and the British Colonial Petroleum Company Limited commenced exploration activities around Okitipupa in present day Ondo State in the south western region of the country. Thereafter in 1938, Shell D' Arcy was granted an exploration license to prospect for oil throughout Nigeria, which granted the company monopoly status over oil exploration in Nigeria up to the end of 1954 (Comanor and Scherer, 1995). In 1955, Mobil Oil Corporation was granted an exploration licence, breaking the monopoly of Shell D' Arcy. The company thereafter started exploration in the same year. The successful drilling of

the first well drilled at Oloibiri by Shell D'Arcy in 1956, described above, marked the beginning of the pipeline project which has reached a total length of over 7,000km as at 2009 (Obanijesu and Macaulay, 2009). Development of pipelines and other petroleum infrastructures, which had been given a boost by the rising price of oil globally, was accelerated when Nigeria joined the Organisation of Petroleum Exporting Countries (OPEC) in 1971 and established the Nigerian National Petroleum Company (NNPC) in 1977, a state owned and controlled company which is a major player in both the upstream and downstream sectors (National Assembly Nigeria, 1990c).

By the late 1960s and early 1970s, Nigeria had attained a production level of over 2 million barrels of crude oil a day from its oil fields, which had increased to a total of ten. It was necessary to extend the pipeline network to all of them in order to evacuate crude oil to the export terminals for onward transport to Europe and America. Although production figures dropped in the 1980s due to the economic slump of the mid 1990s, this did not affect the pipelines already built; further expansion was, however, halted until the beginning of 2004, which saw the total rejuvenation of oil production to a record level of 2.5 million barrels per day, with a projected estimate aimed at increasing production to 4 million barrels per day by the year 2010. This has enormous implications for expansion in the network of petroleum pipeline to connect the new oil fields being developed across the coastal areas of the country. Petroleum production and export, which mainly depends on transportation through the pipelines, play a dominant role in Nigeria's economy and has over the past three decades accounted for about 90% of its gross earnings (Duruigbo, 2004).

4.8.1 Phases in oil pipeline development

Pipeline projects received a boost in 1961 when Shell's Bonny Terminal was commissioned for scheduled export of crude oil from Nigeria. In the same year, Texaco Overseas started operations in Nigeria and also built its own pipelines, adding to the initial length of pipeline in the country at the time. In1962, Elf started exploration operations in Nigeria. This resulted in the discovery of the Obagi oil field and the Ubata gas field in 1963. Another oil company called the Nigeria Agip Oil Company (formally known as Safrap) started operations in the Gulf area which

resulted in its first oil find in 1965 at Ebocha native communality in the Niger Delta region. The visible prosperity of the oil companies in the first five years of oil discovery attracted other foreign oil companies to the country. The Phillips Oil Company was the next entrant and was solely run by foreign oil companies. The company started operations in the then Bendel State in 1966 but did not make any substantial discovery of oil over a period of about fourteen months. It drilled its first successful oil well in the last quarter of 1967 in a community called Gilli-Gilli within Bendel State; this led to the extension of the network of pipeline to Bendel the same year.

One of the premier oil companies, Elf, extended its production activities to Rivers State in 1967; this yielded a daily production rate of 12,000 barrels. In 1968, Mobil Producing Nigeria Limited was formed with Nigerian equity interest and subsequently the Gulf's Terminal at Escravos was commissioned in 1970 with pipeline linkage which substantially increased the length of the pipeline (Frynas, 2000).

The then newly established Mobil started production from a record four wells at Idoho Field, necessitating the extension of the pipeline to connect the newly established oil wells. With the enormous growth in oil and gas activities in the country from 1956 when oil was first discovered in the latter part of the 1960s, the Nigerian government decided to assume the role of a regulator in the industry through the establishment of the Department of Petroleum Resources Inspectorate started in 1970. This led to the establishment of more oil terminals in the country. Subsequently, in 1971, Shell's Forcados Terminal was commissioned and thereafter, Mobil's terminal at Qua Iboe was commissioned in 1973.

Regulatory activities of the Department of Petroleum Resources gave rise to the first Participation Agreement with the government in 1973; as a result, the Federal Government acquired 35% shares in the oil companies operating in the country, giving the government and people a role in the management of the oil and gas industry. Another oil company called Ashland started a Production Sharing Contract with the then Nigerian National Oil Company (now Nigerian National Petroleum Corporation) in the same year, and had permission to build further pipelines to connect its oil fields. The Pan Ocean Corporation drilled its first discovery well at

Ogharefe village in the Niger Delta region in 1974 in a Second Participation Agreement with the Nigerian Federal Government, increasing its equity to 55% in all the foreign oil companies.

The Government established the Nigerian National Petroleum Corporation (NNPC) by Decree in 1977 (National Assembly Nigeria, 1990c), in order to participate more in the oil and gas industry. In 1979, the Third Participation Agreement was entered into between the government and foreign oil companies. This agreement increased its equity to 60%. The Fourth Participation Agreement resulted in the nationalisation of the British Petroleum shareholding. This gave the Nigerian National Petroleum Corporation 80% equity and Shell 20% in the joint venture that resulted. The joint venture changed its name to the Shell Petroleum Development Company of Nigeria (SPDC) in 1984. In 1986, the signing of the Memorandum of Understanding paved the way for the 1989 Fifth Participation Agreement, which brought Elf and Agip into the equity, giving rise to a new outlook of equity holding which included: the NNPC (60%), Shell (30%), Elf (5%) and Agip (5%). This was again followed in 1991 by another round of negotiation which culminated in the signing of another Memorandum of Understanding and the Joint Venture Operating Agreement in 1993. All the pre-1993 production sharing agreements had a profound influence on pipelines and other petroleum infrastructure development across the country, concentrated in the Niger Delta region, where most of the production activities took place (Manby, 1999).

The Nigerian nation generated unprecedented revenue from the sale of oil in the international market, especially in the wake of the Gulf War in 1991 (Klare and Volman, 2006; Ihonvbere, 1990). The economic windfall that the nation experienced during and after the Gulf War gave rise to agitations against the state because of its pattern of expenditure, which was viewed as favourable to the oil producing region. The clamour, which started peacefully, later degenerated into militant actions, culminating in widespread pipeline vandalism in the late 1990s through to the early part of the 21st century (Master Web News Report, 2010; Brume, 2007).

Furthermore, another production sharing contract was signed after 1993. This resulted in the formation of a company called the Shell Nigeria Exploration Company (SNEPCO). The Sixth Participation Agreement gave equity shares as

follows: NNPC (55%), Shell (30%), Elf (10%) and Agip (5%). In 1995, SNEPCO started drilling exploration, recording landmark oil finds in the Odudu oil field which is predominantly offshore. Thereafter, investment in liquefied natural gas resulted in the Nigeria Liquefied Natural Gas project (NLNG) 1999. This culminated in the NLNG's first shipment of gas out of Bonny Terminal in 2000 (Frynas, 2000; Frynas, 1998). The success of the project opened another line of national revenue for the country and further opened a new frontier in the growing network of oil pipelines connecting the gas production fields spread across the Niger delta region (Ite, 2007).

The post Gulf War agitations of the 1990s continued through to the 21st century, climaxing in armed struggle with the return of civil as opposed to military rule in Nigeria, resulting in a near halt of production and other activities in the country at the end of the first decade of the 21st century. Vandalism which was mostly associated with agitation in the Niger Delta region of the country, soon after spread across the network of petroleum pipelines, causing oil spill and affecting the ROW communities in the process.

4.8.2 Systems of pipeline in the pipeline network in Nigeria

Oil pipeline operates in the form of discrete systems, conveying both crude and refined petroleum products to all parts of the country. The pipelines, most of which are owned by the national oil company, traverse many communities, transporting petroleum products to different parts of the country. The multi-product pipelines transport oil from the refineries and import jetties located along the coast to the 22 storage depots located in disparate locations nationally. The four refineries as of 2009 are located in Kaduna (1), Port Harcourt (2) and Warri (1). While the refineries in Port Harcourt and Warri are strategically located within the oil rich Niger Delta region, in fulfilment of the industry localisation factor of nearness to raw materials (Jones and Woods, 2002), the location of the refinery in Kaduna is based on both political exigency and the location of the market for the refinery's products. Apart from the refineries, there are two offshore terminals at Escravos and Bonny, and four jetties located at Okrika, Atlas Cove, Warri and Calabar, all of which are connected to the pipeline network.

In addition to the oil pipelines, a number of gas pipelines exist in the southern part of the country and even extend to some West African countries, for the purpose of gas supply to the Benin Republic, Togo and Ghana (Abolurin, 2008). The gas pipelines, which have also been targets of vandalism, are eight in number.

Table 4: Systems of the pipeline network in Nigeria

1	System 2A	Warri–Benin–Ore–Mosimi
2	System 2AX	Auchi–Benin
3	System 2B	(a) Atlas Cove–Mosimi–Ibadan–Ilorin (b) Mosimi–Satellite (Ejigbo in Lagos) (c) Mosimi–Ikeja
4	System 2C	Escravos–Warri–Kaduna (crude lines)
5	System 2D	(a) Kaduna–Zaria–Kano–Zaria–Gusau (b) Kaduna–Jos–Gombe–Maiduguri
6	System 2E	Port Harcourt–Aba–Enugu–Makurdi
7	System 2EX	Port Harcourt –Aba–Enugu–Makurdi–Yola
8	System 2CX	(a) Enugu–Auchi (interconnection) (b) Auchi–Suleja–Kaduna (c) Suleja–Minna
9	System 2DX	Jos-Gombe

Source: Fieldwork 2009

As seen in Table 4 above, the network of petroleum pipelines in Nigeria consists of nine systems. The nine separate systems of pipeline integrate to form the greater network of pipelines in Nigeria and operate independently of one another.

System 2A operates from Warri through Benin and Ore to Mosimi in Lagos. This system of pipeline traverses three states (Delta, Ondo and Lagos states) and two geopolitical zones (the Niger Delta and South Western zones) of the country. It transports refined petroleum products to and from the oil depots at Benin and was one of the first systems of pipeline to be constructed in Nigeria.

System 2AX is one of the shortest systems and operates from Auchi to Benin, feeding the two distribution facilities in Edo State. System 2B consists of three sub-systems, namely: the Atlas Cove–Mosimi–Ibadan–Ilorin sub-system, the Mosimi–Ejigbo Satellite sub-system in Lagos and the Mosimi–Ikeja sub-system. The Atlas

Cove–Mosimi–Ibadan–Ilorin sub-system is a major hinterland product supply pipeline that traverses three states in the south western and north central geopolitical zones supplying petroleum products to the storage depots located along that supply axis. The third sub-system in the 2B system of pipeline runs from Mosimi to Ejigbo, all in Lagos state in the south western zone. This sub-system is an intra city supply line that feeds the population of more than 9 million with petroleum products.

The system 2C pipeline has its origin at Escravos in Lagos state. It is a crude oil supply system that runs through Warri to Kaduna. This system is the crude oil supply channel to the refinery in Kaduna. The 2C system is a long distance pipeline that traverses seven states and four geopolitical zones of the country. Another system of pipeline that is also composed of sub-systems is the 2D. This system has its origin in Kaduna and runs through to Gusau in the North West and Maiduguri in north eastern zones. The two sub-systems are the Kaduna–Zaria–Kano–Zaria–Gusau and Kaduna–Jos–Gombe–Maiduguri sub-systems. The 2C system operates only in the northern region of the country.

System 2E originates at Port Harcourt, and runs through Aba and Enugu, terminating in the Makurdi products distribution depot. This system is a major supply source that cuts across Rivers, Abia, Enugu and Benue States. System 2DX originates in Jos and operates only to Gombe, supplying products between the two states; while the 2CX System consists of three sub-systems, namely: the Enugu–Auchi interconnection sub-system, the Auchi–Suleja–Kaduna sub-system and the Suleja–Minna. This system is the longest in the network of pipelines in Nigeria.

Gas pipelines also crisscross the southern region of the country. Mostly owned by the Nigerian Gas Company, the gas pipelines supply natural gas to various end users in the country and across the West African sub region. There are eight gas pipeline systems, three of which are: the Sapele gas supply pipeline, which belongs to the Power Holding Company of Nigeria; the gas turbine at Ogorode near Sapele, and the Aladja system, which supplies the Delta Steel Company and the Ajaokuta Steel Company. This system is envisaged for supplies to the northern part of the country as well as the Imo River gas turbine.

Oil and gas pipelines are mostly buried about a metre below the surface of the earth. However, because of the undulating nature of land surface in Nigeria, a considerable length of the pipeline can be seen either on or above the ground. The ROW measuring 25 metres wide are specifically acquired by the government throughout the communities traversed by the pipelines in Nigeria (Abolurin, 2008; Brume, 2007; National Assembly Nigeria, 1990d). The initial oil project of 1956 needed no protection because the people in the communities traversed by the pipeline saw it as a form of government presence which they were obliged to protect; however, the pipeline became the object of vandalism in the 1980s in the Niger Delta region. Acts of vandalism continued throughout the 1990s to the northern region, and had implications for land contamination, oil spillage and loss of products valued in billions of dollars (Onuoha, 2008b).

4.8.3 Pipelines and oil transportation Nigeria

The relative economic advantage, administrative convenience and speed of oil product transportation by means of pipelines, already established in other countries like India, Britain and Canada, was relied upon in the rapid post-oil discovery activities in Nigeria (Nwilo and Badejo, 2006). With the 1958 discovery of oil in Nigeria's Niger Delta region, four additional oil companies acquired operational licences and began operating between 1960-1966, expanding the scale of exploitation and exploration activities with a commensurate increase in the expansion of petroleum pipeline infrastructure and associated ROW in the country (Atsegbua, 1999). The relative competition led to the granting of the first offshore licences at the time. The new entrants were Texaco and Gulf (now Chevron) in 1961, and Safrap (now TotalFinaElf) and Agip in 1962 (NNPC, 2002).

The four new entrants and Shell-BP all implemented aggressive expansionist production policies that relied heavily on pipelines for transportation of products from all points of production to export terminals, simultaneously creating the buffer known as the ROW of pipelines (Omeje, 2006b; NNPC, 2002). The production output increased steadily to 400,000 barrels per day by 1966 and 1 million barrels per day by 1970, with commensurate anticipatory increase in the lengths of pipeline and associated ROW in Nigeria. The exploration and production activities in the oil industry in Nigeria up to 1970 was completely dominated by foreign oil companies,

with Nigeria as a country playing only a passive role of Royalties recipient and Tax Collector towards the operating oil companies. The expansion of oil pipeline at the time was skewed towards the export terminals. However, in 1971 Nigeria joined the Organisation of Petroleum Exporting Countries (OPEC) which availed the country and encouraged it to take a more active role in its oil industry. That same year, the Nigerian National Oil Company was created and thereafter Nigeria began active participation in its national oil industry (Abiodun, 1974).

4.8.4 The expansion of pipeline in Nigeria

The entrance in 1971 of Nigeria into the membership of the Organisation of Petroleum Exporting Countries led to the active participation of the country in the oil industry (Abiodun, 1974). The scope of production activities increased, together with a simultaneous expansion in the network of pipelines connecting the new oilfields as these were discovered and developed. The increase in the length of pipelines translated directly into an associated increase in the geographical space that fell under the classification of pipeline ROW (Obi, 2007a). Nigeria recorded an unprecedented oil export boom in the 1970s (Pinto, 1987).

The revenue receipts from oil export translated into monumental national economic development which occasioned large scale road infrastructural development across the length and breadth of the country (Pinto, 1987). The relative per capita income in the country at the time and the widespread road infrastructure development provided the incentive for car ownership across Nigeria, creating a national demand for petroleum products in the hinterland, far from the oil producing areas of the country. The demand for petroleum products across the country led to the extension of pipelines across all geopolitical zones (Madujibeya, 1976). Four refineries were established in the country for the purpose of refining crude oil locally for domestic consumption.

While three of the refineries were located in the oil producing areas of the country in satisfaction of the economic theory of nearness to raw materials, one was located in Kaduna for strategic political and economic considerations (Mayall, 1976). The oil boom of the 1960s and 1970s snowballed into petroleum infrastructure development in Nigeria. The national leadership responded to the astronomical rise in demand for

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local petroleum product, occasioned by the widespread increase in car ownership and industrialisation, with the establishment of the Port Harcourt Refining Company in 1965 in Port Harcourt, the regional headquarters of the oil producing Southern region of Nigeria.

The Port Harcourt Refining Company had installed a refining capacity of 60,000 barrels per day at full capacity in a bid to meet in-country product demand (NNPC, 2002). The Port Harcourt refinery operated at full capacity for over ten years but over that time product output fell substantially below national demand, which was also growing due to the relative economic prosperity engendered by the boom in national earnings from crude oil export. Another refinery was established at Warri in 1978, hundreds of kilometres away from the Port Harcourt refining plant. This plant had an installed refining capacity of 125,000 barrels per day and aimed to bridge the difference between national product demand and output from the premier national refinery in Port Harcourt (Nwokah and Ezirim, 2009).

By the mid 1980s, he combined product output of 185,000 barrels per day from the Port Harcourt and Warri refineries still fell far below demand for national petroleum products, and so the government was moved to establish another refinery over a 1,000 km away from the oil producing region in the north western hinterland of the country. The establishment of the Kaduna refinery was interpreted in strategic national economic terms (Pearson, 1970). Industry analysts have, however, expressed reservations about the relative economic gain in the establishment of a refinery tens of hundreds of kilometres away from the region of crude oil production (Pearson, 1970). They argue that the cost of transporting the crude oil to the plant from the Niger Delta Region, where it is produced, is enormous and could have been saved for other pressing national economic infrastructural development needs, since there was no scarcity of lands for refinery establishment in the country's oil producing region.

The criticism that greeted the establishment of the Kaduna refinery at such a distance from the source of its principal raw materials underpinned the decision of the government to establish another refinery at Eleme, a few kilometres away from the

premier refinery in Port Harcourt (installed capacity of 150,000 barrels per day in 1989) (Pearson, 1970).

The growth in product demand and supply was simultaneously met with a progressive increase in the length of pipeline distribution networks linking various distribution points in the country (Nnadi and Cmilt, 2007). The combined output of about 385,000 barrels from the four refining plants was only able to meet national demand through the expanding national networks of pipelines for a couple years after the commissioning of the last built refinery at Eleme in 1989, and this left a product supply shortfall that led to the need for Nigeria to import product to fill the demand-supply gap.

4.9 Pipeline as a distributed infrastructure in Nigeria

National petroleum product demand exceeded the combined installed capacity of the four refineries, and so the Petroleum Products Marketing Company resorted to large scale importation of petroleum products in an attempt to cushion the product's supply shortfall, which had become acute in the mid 1990s. This shortfall worsened during the first half of the first decade of the 21st century due to ageing plants at the refinery (NNPC, 2002). With an average age of 31 years and poorly timed maintenance, the installed capacity of the refineries in the country has significantly reduced. Massive importation of product covering up to 80% of the daily national demand is being aggressively pursued. Product import has also created the need for additional pipeline network expansion to connect petroleum import jetties, which is expected to extend the length of the associated ROW (Adenikinju et al., 2005) .

The network of petroleum product distribution infrastructure in Nigeria is closely linked to the relative spread of demand and the country's geopolitical groupings (Ogunleye and Oladeji, 2005). From the point of view of product imports across the coastal fringes of the country, the need to further extend the pipeline network for efficient product delivery into all areas of demand in the hinterlands is ever-increasing. Similarly, there is a need to expand pipelines for crude oil transportation to the refineries and also for day-by-day export increases, with the discovery and development of new oil fields across the oil-bearing regions of the country. The

distribution of petroleum infrastructure in Nigeria is considered on the basis of the Nigerian national geopolitical spread below.

4.9.1 Pipelines and the north western geopolitical zone

The north western geopolitical zone of the country has its fair share of petroleum infrastructure distribution in the country. The zone is the only non-oil producing zone of the country that hosts a refining plant, the Kaduna Refining and Petrochemical Company, with two destination depot facilities in Kano and Gusau and a booster station at Zaria; the zone also has its fair share of petroleum infrastructural installations in the country (Ogunleye and Oladeji, 2005). The refinery and two destination depots in Kano and Gusau are connected by a network of pipelines from other parts of the country. The network of petroleum pipeline traversing the six states in the zone created thousands of associated ROW. Cases of pipeline failures due to acts of vandalism and theft of petroleum products are rare in this zone of the country (Onuoha, 2008b).

4.9.2 Pipelines and the North eastern geopolitical zone

The north eastern geopolitical zone of the country is serviced by two destination depots at Gombe and Yola. The zone is also serviced by a distribution depot at Biu Town with a network of pipelines. Unlike the north western states, where the pipeline network traverses three of the six states in the region, the network of petroleum pipeline traverses five of the six states of the north eastern region of Nigeria (Onuoha, 2008b). Thus in five out of six states, the network of petroleum pipeline and associated ROW is fully-developed.. Cases of vandalism and theft of petroleum products are isolated in the region but pipeline failures due to ageing occur occasionally (Abolurin, 2008).

4.9.3 Pipelines in the north central geopolitical zone

The North Central Zone of the country is serviced by two destination depots at Minna and Suleja and two distribution depots at Ilorin and Makurdi. The petroleum products in the zone serve a dual purpose, dispensing products for consumption within the zone and also distributing products out to the north eastern and north western geopolitical zones of the country. An array of pipeline networks dot the landscape of this zone, connecting other, product intake zones to the south of the country and extending to other zones to the north of the country for onward distribution of products to the north eastern and north western hinterlands (Nnadi and Cmilt, 2007).

4.9.4 Pipelines and the Niger Delta Zone

The Niger Delta zone of Nigeria is the principal oil-producing area of the country, accounting for well over 80% of the nation's daily oil production and containing over 85% of the nation's proven oil and gas reserves. Three of the four refineries in the country are located in the zone. There are multi-product pipelines for transport of oil both crude and refined from the refineries at Port Harcourt and Eleme and the import-receiving jetties at Okrika, Warri and Calabar. The network of pipelines in the zone also transport crude to the export terminals at Escravos and Bonny (Abolurin, 2008). The plethora of pipelines in this zone is being further expanded by the renewed drive by the authorities to collect of natural gas for domestic consumption and for export.

4.10 Chapter summary

This chapter has reviewed the pre and post colonial activities that led to the development of the network of petroleum pipelines and their associated ROW in Nigeria. It has also looked at the social and economic impacts of the oil industry from its 1956 discovery, in the present day Bayelsa State, up to the present day. It has found that in only about five decades of the operation of the oil industry, the network of pipeline has come to traverse the entire region of the country from the forest zone in the south to the desert and semi-desert zone of the north. The

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geographical spread of the pipeline network is closely associated with the historical development of transportation routes across the country.

Overall, the development of the network of pipelines, which measures about 7,000km, also led to the creation of associated statutory ROW which has not been properly managed. As a result, pipeline vandalism and other intrusive activities have compromised the intended integrity of the ROW, spilling oil into the environment and creating financial losses for the government in terms of forfeited revenue and costs of repairs, as well as damaging the environment around the pipelines and destroying the means of subsistence for many households in communities located close to the pipelines.

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CHAPTER 5

RESEARCH METHODOLOGY

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CHAPTER 5

RESEARCH METHODOLOGY

5.1 Introduction

In chapters one, two, three and four, the research problem, objectives and questions were contextualised, relevant literature reviewed and the research setting described. The research agenda was set out by identifying, defining and contextualising the problems of pipeline management within the wider literature on corporate social responsibility and sustainable development. The feasibility of a collaborative management framework as a management option for the ROW of petroleum pipelines in Nigeria was revealed. This sets the stage for articulation of a methodology based on the pilot studies and theoretical argument towards a Collaboration Based Management Framework for the ROW of Petroleum Pipelines in Nigeria.

To achieve the objectives of the research, a mixed social research method consistent with the principles of collaborative planning was used (Lane and McDonald, 2005; Margerum, 2002; Healey, 1997b), the approach explores emerging forms for the system and practice of collaborative planning which has its origin in the British planning system but, with implications for planning systems across the globe. It's emphasis is on collaboration and consensus-building in resolving land use and environmental management-related conflicts. It is encapsulated within the context of managing conflicts over the use and development of land, and promoting particular qualities of places through a governance process that engenders the collaboration of all stakeholders (Eichler, 2006; Healey, 1998b). Collaborative planning practice as adapted for this study provided the foundation of evidence-based policy making for a crisis free, sustainable management of space-based environmental challenges, like the ROW problems in Nigeria. For this study, it has incorporated the use of geographic information systems to re-discover the lost pipeline networks in urban and rural Nigeria.

The current research seeks to explore how collaborative planning principles can be applied in finding solutions for environmental and socio-economic problems within

the context of the pipelines in Nigeria. Because of the universality of the spread of pipelines and the different contexts in which they manifest the world over, and the peculiar nature of the problems in the Nigerian context, a management solution for a crisis-free operation of the pipelines infrastructure must involve a robust synchronization of data derived from all actors. The aggregation of this data presents a true picture of the contending and complementary forces on the ROW and the impact they have had on the crisis of management of ROW up to 2010.

The mixed method approach provided a more appropriate approach to addressing the contemporary concerns of stakeholders for the management of ROW in Nigeria. The research adopts a social research strategy.

5.2 The social research strategy

The research, being an investigation into an environmentally-based social problem, adopted a general social science research strategy (Bryman, 2008; Flyvbjerg, 2001). Research is an attempt to derive knowledge that can be generalised by addressing clearly defined question and objectives with systematic and rigorous methods. Research is designed to provide evidence to answer a research question, support or refute a hypothesis which can be generalised (Cooper et al., 2009; Crotty, 1998; Eisenhardt, 1989).

According to Johnson *et al.*. (2007), in deciding to conduct social research, the first step to be taken is a decision as to the strategy or strategies to be adopted in executing the study. This is because there are several ways of conducting social research and deciding which one is appropriate for a particular case can sometimes be a difficult task (Stake, 1995).

According to Pettigrew (1990), the choice of research strategy depends on some preconditions, namely:

i. The research aim, objectives and questions;
ii. The level of control the investigator can exercise over actual behavioural events;
iii. The level of contemporary or historical focus of the research.

Research objectives are of primary importance in deciding which strategy to adapt for an enquiry. This is because the whole essence of the enquiry is to explore the research objectives in order to answer the research questions. Furthermore, whether the research is contemporary, prospective or historical also has implications for the choice of strategy to be adopted when answering the research questions.

Research questions are generally categorised into four types, namely: "what," "who," "how" and "why" (Rounding and Ulcers, 2009; Johnson and Onwuegbuzie, 2004). The nature of the enquiry and explanation focused on by the research underpins the question and strategy to be used in achieving the objectives. For instance, the "what" question is appropriate for experiments, case studies or surveys and can be justifiably used as an exploratory enquiry strategy; the "who" question is most likely to be appropriate as a strategy for archival studies while the "how" and "why" questions are more explanatory in nature and would be likely to be used for conducting case studies, historical and experimental research (Corner, 1991; Eisenhardt, 1989).

According to Tashakkori and Teddlie (2003), considering the researcher's position in relation to the object of study, the experimental strategy is preferred if the researcher can exercise control over the behaviour of subjects or their own behaviour has influence over the objects; otherwise, survey, history, archival analyses and case studies are the appropriate approaches. In addition, while the use of experiments, surveys, case studies or archival analyses is likely to be appropriate for research focuses on contemporary phenomena within specific real life contexts, research having to do with historical analyses would favour a historical strategy.

In particular, this research investigates a contemporary phenomenon with a view to formulating a Collaboration-Based Petroleum Pipeline ROW Management Framework for Nigeria. The research questions have been articulated in terms of "How", "Which", "What" and "Why" questions, as enumerated in chapter one. However, substantive research employs a case study research strategy and a mixed methods approach for data collection, consistent with principles of collaborative planning and corporate social responsibility, in order to promote sustainable development on the ROW of pipelines in Nigeria (Hardin, 2009; Healey, 1998b; Feeny et al., 1990).

5.3 The research design

The design of the research process is guided by the choice of research strategy, which is justified section 7.2. This involves how data for the research is to be collected and analysed in order to answer the research questions. This is illustrated below.
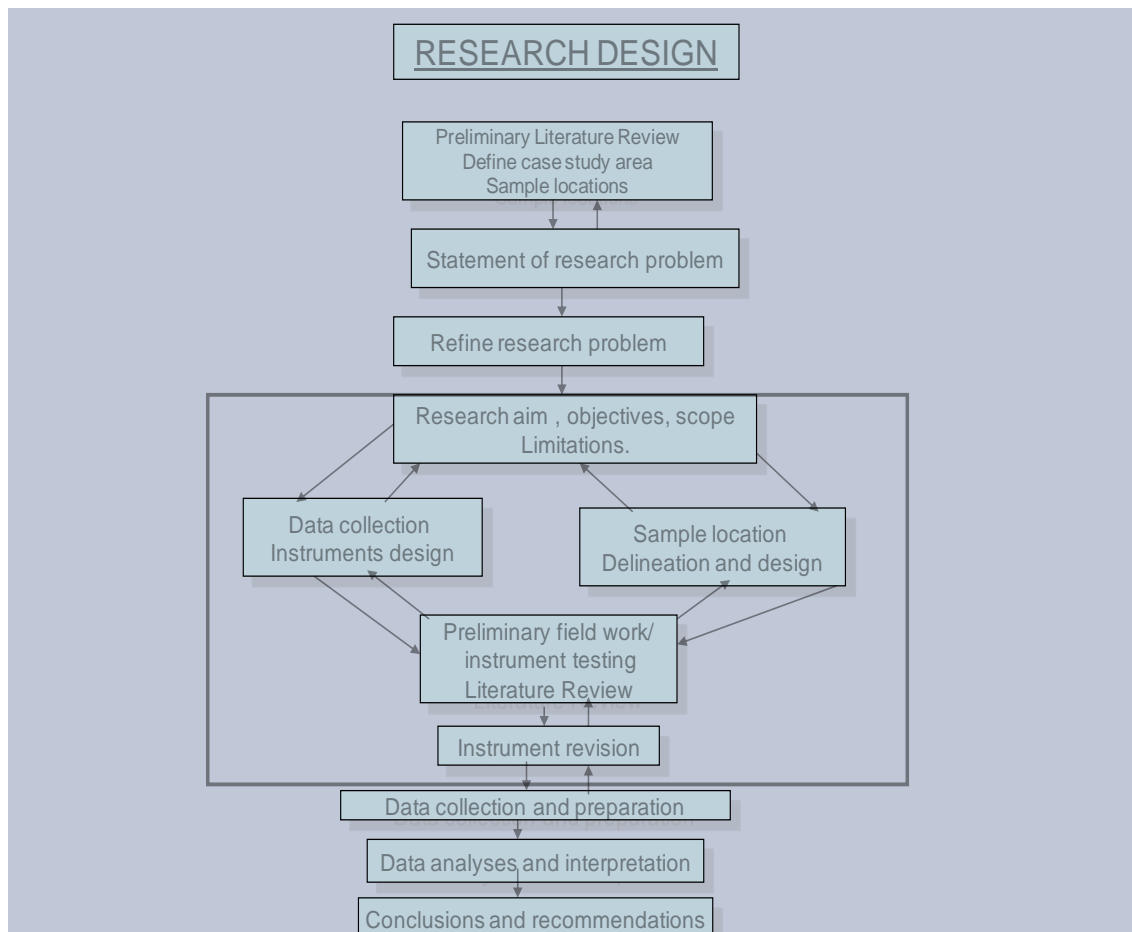
Figure 6: Research Design

In the research tradition there has been a long history of academic debate regarding the veracity of the quantitative and the qualitative methods in different research contexts. Bryman (2008) opined that the distinction between them was not originally on the basis of the type of evidence generated by their application but on the basis of their wholly different philosophical foundations (See also in Yin, 2008; Moustakas,

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1994). In this section, the different uses of these methods, which have been employed for data sourcing and analysis, are discussed.

The quantitative method in environmental studies is associated with the use of surveys and other aggregate data sources, to test formulated hypotheses, where influencing factors are arbitrarily pre- selected; or to answer research questions, where doing so is meant to achieve the research aim (Bryman, 2008; Brunsdon et al., 1999). The shortcoming of this method is the problem of gathering significant data that reflects a sample size representative of the population size in a survey (Larsson, 1993). With quantitative research, a larger population size may translate into a larger sample size, based on the consensus opinion of most advocates of the method. The general consensus is that to be valid, the number in the sample must be 5% of the survey population (Dane, 1990). For the current study, the research context is the over 7,000km of pipeline in Nigeria together with their 25m ROW, out of which four case study communities were selected, in the belief that they are representative of the entire research context.

Therefore, taking the above discourse into account, it became central to explore the range of environmental and socio-economic issues associated with the management of the ROW, with a view to understanding and interpreting their multiple interrelated realities. This required the researcher to probe into the complexities of difficult management realities of the incongruent activities on the ROW. This makes the use of the mixed method more appropriate for answering the research questions in order to achieve the stated aim and objectives of the study.

Having chosen the case study approach as the research strategy, the study is designed to follow the case study procedure consistent with the prescription of Yin (2008). As shown in Figure 5 above, the researcher's initial knowledge, coupled with a preliminary literature search, helped to generate the research question which served as a guide for the robust literature review and data analysis that led to theoretical, methodological, practical and policy contribution to knowledge of this field of study.

5.4 Literature review

A comprehensive and detailed literature review is important for research in the social sciences (Da Silveira et al., 2001; Hart, 1998). In this study, it has been argued as indispensable for two reasons. As an interdisciplinary study, a comprehensive literature review is needed to place the social, economic and environmental externalities of the ROW management communities in a theoretical context. The literature review process helped to construct a holistic, interdisciplinary understanding of the problem and the state of previous work in the field, while also helping to refine the research questions, aim and objectives.

Dooley (2002) suggested that in order to collect a reliable data set, evidence from case studies needs to be triangulated. This position has also been supported by other case study researchers (Pandit, 1996; Eisenhardt, 1989). They caution that the case study researcher needs to collect data from as many sources as possible, so that triangulation may be used to test the integrity of each of set. In doing so, the eventual analyses will be based on a data set that is reliable. Because of the extensive data requirement for this research, data was collected from various sources which ranged from physical measurement, official documents, archival records, interviews, mapping and observation in all the case studies. This enabled the comparison of information on the same item of investigation from more than one source, in order to ascertain its validity.

After the initial statement of the research aim, objectives and the articulation of the research problem based on the preliminary review of literature, two pilot studies were conducted. The pilot studies proved very useful and led to the refinement of the research aim, objectives and a further re-articulation of the research problem to underpin their essence in the whole research process. The main features of the pilot studies as conducted for this research are outlined below.

5.5 Pilot study

Two pilot studies are conducted to test survey instruments such as questionnaires for both structured and unstructured interviews in social research (van Teijlingen et al., 2001). These have been found to be invaluable in quantitative and qualitative research (Perry, 1998). Regardless of whether the research is qualitative, quantitative or employs a mixed method for data collection, pilot studies have proven to be very useful for refining and further developing survey instruments, framing questions, and collecting background information and adapting the research process to the challenges of the research context (Peck et al., 2000; Stake, 1995). According to Yin (2008), the pilot study helps researchers to refine the data collection plan, both in respect of the content of the data and the processes followed in obtaining the data and the conceptual framework for the research.

The first pilot study was conducted in January 2008. In the course of this pilot study, the researcher visited the Headquarters of the Nigerian national Petroleum Corporation in Abuja and the Investigation Unit of the Police Nigerian Police Force where information about incidences of vandalism in the country and other secondary literature relating to the history of oil and gas development in Nigeria were obtained.

Data generated during the first pilot study and newspaper reports about the trend of vandalism in Nigeria were processed upon return to the University. This led to the identification of an initial ten potential case studies which were then visited during the second pilot study in august 2008. During second pilot study, the researcher sampled issues relating to safety (security), availability of gate keepers and other logistics in the ten provisional case studies namely, Kano, Kaduna, Abuja Mina and Otukpo in the northern part of the country and Port Harcourt, Benin, Lagos Enugu and Warri in the southern part of the country. Processing of the data from the second pilot study and other considerations informed the choice of the four case studies.

In addition, the provisional findings from the pilot study can also be useful as part of the evidential building block in the research process (Yin, 1999). It is essential to give the research project a trial run; otherwise it is difficult to ascertain whether the

substantive research will run its course successfully. The pilot study for this research helped the researcher to:

- Identify reliable sources of data, key informants and focus groups;
- Assess the appropriateness of the selected survey instruments;
- Assess the appropriateness of the proposed methods of data analysis;
- Further develop understanding of the study and the research context.

Abuja, the Nigerian Federal Capital Territory was chosen for the conduct of pilot study for the following reasons:

- Abuja is, by law, a miniature Nigeria (National Assembly Nigeria, 1990a). This is because all Nigerians, irrespective of their state of origin, can automatically become citizens of Abuja provided they reside in Abuja with a visible means of livelihood.
- Abuja is the political and administrative headquarters of Nigeria. Being the centre from where the whole country is administered, opportunities are created which attract not only Nigerians from every state, but foreigners from many countries of the world as well.
- Because of the statutory provision that entitles all Nigerians to land and other resources in Abuja, all cultures and traditions of people across Nigeria are represented in Abuja. The territory is also the researcher's place of primary abode where he works as a planning officer with the government and this thereby gave him the needed critical initial knowledge of the research context in Abuja and access to information.

5.6 The case study as a research approach

5.6.1 Case study selection

The network of pipelines traverses many of the 36 states and the Federal Capital Territory in Nigeria. Nigeria is classified into six geopolitical zones for administrative and political exigencies (Chukwu, 2004). The country was broadly divided into northern and southern regions by the British colonial explorers (Nagziger, 2008). The colonial division and the present day geopolitical arrangements of governance in the country have influenced socio-economic

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development processes across the country (Omotola, 2010). These arrangements have resulted in people of similar ethnicity and cultural affinity being grouped together from the smallest administrative unit, called local government areas, through states and geopolitical zones in hierarchy to the national level. Development of core national infrastructures in the country was undertaken in this order to achieve an even national spread and spatial equity; hence there is an even spread of the pipeline network across the country from the southern to the northern parts of the country.

Selection of respondents within each case study was guided by the case study screening process in a single-case design advocated by Yin (1993). In so doing, three factors were considered, namely: representativeness, comparability and the frequency of reported vandalism incidence. Representativeness takes into account whether the case study is truly representative of the region in terms of the presence of the pipelines. Comparability considers the density of the networks of pipeline in relation to other states within the same region, while the third factor, the frequency of reported cases of acts of pipeline vandalism, looks at the average cases of reported acts of pipeline vandalism in the selected case study, in relation to other states within the same region.

The exercise of case study identification which was conducted during the pilot study gave the researcher further insight into the complexity of the problems of pipeline ROW management across the different regions of the country, its trans-regional vagaries in terms of severity and impacts on the means of subsistence of the people and the net national economic losses in products, cost of pipeline repairs and environmental damages.

Based on the principle outlined above and the north–south divide of the country, two case studies were selected from the two regions in order to have a national geopolitical character in the quality of the data generated. Four case studies were selected based on the geopolitical[9] groupings of Nigeria. Two case studies each were selected from the northern and southern regions of the country respectively.

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[9] A geopolitical zone is Nigeria derives from the division of the 36 states of the country into six zones, each has a particular geographical and political affinity.

Selection of the case studies was informed by the two pilot studies undertaken prior to the substantive fieldwork.

Abuja was selected as one of the case studies from northern Nigeria. Selection of Abuja as a case study was informed by its status as a new purpose-built administrative and political capital of Nigeria with representations from all zones of the country in its population. Otukpo in the Idoma[10] Senatorial District of Benue State in the north central zone was selected as the second case study from the northern region, based on findings during the two pilot studies (see section 5.9.1 below) which revealed cases of vandalism and environmental pollution in the area. Enugu in the south eastern zone was selected based on its role as a major pipeline distribution hub with high cases of recorded vandalism. Port Harcourt was selected because of its status as the traditional headquarters of the oil producing Niger Delta Region of Nigeria.

5.6.2 Justification of case study as a research approach

Having discussed the justification of the case study as research approach within the overarching social science research strategy, there is a need to evaluate its validity for the type of socio-environmental and economic study which forms the crux of this research. According to Hartley (2004), a case study approach is useful as a strategy to study a problem in-depth, to understand the interplay of socio-economic forces and processes as exemplified in the case studies, and to understand the variously manifesting scenarios and situations in a particular environmental context (See also,Yin, 2008; Verschuren, 2003). The case study strategy has always been favoured as a research approach by social science researchers. This can be traced back to the 1920s when Robert and Helen Lynd undertook the study of social and environmental problems in a medium-sized American city over a period of about two years (Zabel et al., 2003; Wakefield et al., 1998; Anderson et al., 1978). The research report presented the social life style of the Midwestern United States and covered six topics which included making a living and a home, training the young, using leisure; engaging in religious practices and engaging in community based developmental activities. The resulting work was very successful and is still in print even today, almost a century later (Yin, 2008).

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[10] Idoma is a major Ethno-linguistic group in the North Central geopolitical zone of Nigeria.

Other investigations into complex environmental phenomena have also chosen the case study approach (Stake, 1995; Schneider, 1977). This research puts the issues of managing the ROW of petroleum pipelines in Nigeria into the wider context of stakeholders' collaboration for public infrastructure management. It aims to create evidence-based building blocks that could inform corporate social responsibility public policy frameworks that promote equity and engender a positive attitude from opposing views for a crisis-free management of the ROW in particular, and other public infrastructures in general. The study covers a wide-range of interrelated public infrastructure management problems manifest across the over 7,000 km of the ROW in Nigeria. Since the study is an exploratory investigation of the problems of management of the ROW in Nigeria, it entails, first of all, examining what takes place within the ROW, including both appropriate and inappropriate activities.

A single approach cannot be used to investigate all the problems of ROW management, due to the diversity between the interested actors - broadly classified into governmental, non-governmental and private actors – each of whom has distinctive features which are not mutually congruent. This implies that it is important to understand the contextual elements, such as the institutional, historical and cultural contexts which may have acted together to create the web of activities that currently manifest themselves on the ROW. Taking cities with strategic national spread across the pipelines to analyse the phenomena of pipeline vandalism and its associated problems is therefore crucial for the development of a collaboration based management of the ROW in Nigeria.

Another reason for adopting the case study approach over other strategies such as experiments and complete surveys lies in the limitations of these latter in their ability to represent the coverage of the over 7,000 km of the pipelines in Nigeria within the three year lifespan of the research. As already discussed, this research requires a succinct understanding of the collaboration-based concepts of linear infrastructure management within the wider context of the public infrastructure management which includes the pipelines. This entails collecting a variety of data, which vary according to the character of the different objects and necessitate the use of different survey instruments, ranging from structured interview questionnaires and focus group discussions to mapping with a digital camera and the global positioning system.

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This (case study) research strategy is also amenable to studies focusing on influencing factors conceived from a positivist perspective, collecting systematically quantifiable data in respect of a number of variables, which are then examined to discern patterns of association in order to answer the research questions (Bryman, 2008). This approach enabled the researcher to explore the full extent and variety of issues involved in the ROW in Nigeria, and provided a data set, which, on analysis, could generate succinct generalisations that provide the framework for a collaborative management framework. On the contrary, experimental research mostly investigates the cause-effect relationship between inputs and outputs, which can be effectuated through experimental design (Gomm, 2004).

However, the case study strategy has been further enriched by other methodological considerations which were employed in the processes involved in data collection and analyses. This case study strategy has been enhanced by the combination of primary and secondary methods of data collection. Primary data were generated from the administration of questionnaires, focus group interviews, key informant techniques and the use of a digital camera and global positioning unit, using the NMEA protocol for mapping the case studies.

Secondary data were sourced from published official documents, statistics, and corporate disclosures by oil and gas companies. Other secondary sources of data include host community development plan frameworks and the Niger Delta Development Master Plan and relevant statutory instruments (Wheeler et al., 2003). The resulting data were then treated and processed for both quantitative and qualitative analyses (Bryman, 2008; Tambunan, 2006; Tambunan and Thee, 2006; Porter and Savigny, 2002b; Esrock and Leichty, 1998)

5.7 Defining the sources of data

Various sources of data provide evidence for case study research (Stake, 1995; Eisenhardt, 1989). The most common sources, however, are: structured and unstructured interviews, mapping, documentation, observations and physical measurement (Yin, 1999). Each of the sources has its own comparative advantages and disadvantages. Yin (1993) averred that documents are relevant for data collection exercise in case study research because they have stable, exact and broad-

based content coverage. Notwithstanding this, documents must be diligently authenticated and not treated as synonymous with literal recordings of events that took place. This is because these recordings might be selective and biased in favour of the recorder or his views on the subject matter of the research. Archival records of other documents must also be used with great care because records in this class of secondary data were produced for a specific purpose and audience, other than the purpose for which they are sought by the case study investigators. For this reason, archival records must be carefully compared with data from other sources in order to ascertain their veracity before they are incorporated into the case study research data.

Interviews provide insightful and originally targeted information for the case study research (Larsson, 1993). As Yin (1999) contested, information obtained from interviews can also be biased due to many reasons, which include the type of questions, interviewer's bias, atmosphere at the time of conducting the interview, and the level of knowledge of the interviewee. Direct observation is one of the first-hand methods that provide contextual and real factual information which can seemingly be error free but is very expensive to undertake.

5.7.1 Data collection techniques

As mentioned earlier in this chapter, data collected for the research is broadly classified into primary and secondary, depending on the sources from which it was collected. While the primary data set was collected directly through interviews with respondents, measurements and mapping, the secondary part of the data was sourced from already existing information through the collection of archival records, newsletters, journals, books, official documents and maps.

5.7.2 Collecting the primary data

Direct observation, interviews and mapping were adopted for collecting primary data for this study. As defined by Webb and Kevern (2001), direct observation is focused on a situation in which the observer has no control over the behaviour of the subjects or signs in the phemonena being observed, nor do they play any obstructive, passive or intrusive role throughout the period of observation. This was done in this research by visiting the ROW of pipelines, and making direct measurements of distances from

the pipelines to the communities, as well as mapping using digital cameras. The global positioning system unit was also used to collect primary data in the form of X/Y coordinates of ground control points. Primary data, which was extensively collected for this research, is reputed to be the more authentic since the investigator collected it on a first hand basis, free of any of the ambiguity which third parties could have introduced (Eisenhardt and Graebner, 2007).

Another aspect of primary data collection was attending community gatherings and engaging community members in discussions regarding the pipelines that traverse their land. The interview method of data collection has become one of the most reliable and widely used techniques of primary data collection (Bryman, 2008). The use of interviews helps the researcher to directly collect data relevant to the research questions, aim and objectives (Lethbridge et al., 2005; Roos, 1987). The interview technique also provides the opportunity to provide further explanation of the questions to the interviewee if need be and even ask follow-up questions that lead to the extraction of more details from the interviewee.

5.7.3 Collecting the secondary data

Secondary data were sourced from already existing information. The researcher employed formal application where the documents sought were held under statutory authorities. This technique was adapted to acquire this type of information, because in such a situation the authorities would need to keep records of the identities of those applying for and to whom data were given, so that information does not fall into the wrong hands (Atkinson and Brandolini, 2001). The techniques used for obtaining both the primary and secondary data for the research made it possible for the researcher to screen the data to ensure that only information ascertained to be reliable formed part of the data used for the study.

5.7.4 Validity of the research design

The case study approach in research has been accepted by many researchers as the ideal design to adopt when there are constraints in time and resources in relation to a research context of an expansive study area or population, which is typical of most field-based social science research (Darke et al., 1998); hence it is widely used for

research the world over. However, the case study approach is viewed by some researchers with scepticism. This group of researchers consider it lacking in rigor and objectivity, contesting that the measure may not produce the same results if applied by another researcher on the same set of subjects. In addressing this concern, however, Yin (1999), suggested the case study as a research strategy that can be subjected to a revalidation process to ensure that data integrity is maintained. This can be achieved variously through construct validity, internal and external validity and reliability checks consistent with Yin (2008).

In achieving cross-validation, this research is designed in a set of successive stages (Riege, 2003). Firstly, the findings from the literature review may be subjected further to content analyses and triangulation through the review of petroleum pipeline management challenges globally. Secondly, the research framework and data collection techniques were piloted through the pilot study to test their effectiveness. Thirdly, primary data collected through direct observation and interviews were triangulated with data from secondary sources. The multiple case-study design involving four case studies also made it possible that problems associated with the single case study approach were eliminated from the research process.

Internal validity can be maintained by making sure that all rival explanations and possibilities were considered before any inference was drawn (Sheridan et al., 1996). For this research design, data validation was managed based on the research framework, which derives from the literature review and baseline information from the Nigerian oil and gas industry and the pilot study. Firstly, the data needed was justified by the research framework. Secondly, in order to collect reliable data, a case study protocol was well-prepared and discussed with the supervisory team and tested in a two stage pilot study that the researcher undertook before the survey instruments were finalised. The interviewees were carefully selected after wide consultation with the supervisory team, stakeholders and practitioners in the oil and gas industry in Nigeria. To ensure that errors were not accommodated in the research, transcripts of the interviews were sent to the interviewees and their feedback received, and in all cases the integrity of the transcription process was confirmed. This was done to

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ensure that there were no misunderstandings during the interview and in the process of transcribing the recorded interviews.

The external validity and reliability for the research were enhanced by the multiple-case study design and the variety of sources from which data for the research were obtained. A pilot study report was presented at the School Architecture, Planning and Landscape seminar series at the University and feedback was received before the researcher undertook the substantive fieldwork for the study. Thereafter, the researcher also made two other presentations of preliminary findings to audiences across the university and received feedback which fed directly into the study.

5.8 Conducting the fieldwork

Because of the multiple case study design of the research, a large amount of data was envisaged and an effective process was developed in order to organise and effectively document the various data components. A data base was created to manage the data gathering process. This section discusses the processes involved in the collection of the primary data. The fieldwork activities were divided into three phases: pre-fieldwork, the fieldwork and post-fieldwork activities.

5.8.1 Pre-fieldwork activities

The first pre-fieldwork activities were the two pilot studies carried out in January and August 2008 respectively. The pilot studies revealed the peculiar security situations in some of the case study areas and offered the researcher the opportunity of identifying gatekeepers for the main fieldwork. The first step involved writing of a set of letters of notification, conveying the approval of the principal supervisor and the authorisation of the University for the Fieldwork to the Chief Executive Officers of all the organisations identified during the pilot studies for visit during the main fieldwork. Another set of letters addressed "To whom it may concern" were also used by the researcher as a way of introducing himself to other organisations that might be discovered to be important for the purpose of data gathering during the fieldwork. Both letters introduced the researcher and assured the organisations and the officers to be interviewed of the utmost confidentiality with which information

given would be treated. They also assured that the data were for academic purposes only.

Secondly, follow-up telephone calls were made to each of the organisations to which letters of introduction had been sent earlier, to remind them and further sensitise them to the visit of the researcher and the contribution the research would make to oil pipeline management, in particular and more generally, to the oil and gas industries. The follow-up telephone calls proved very useful because organisations that were initially sceptical about the purpose of the fieldwork were able to ask questions and receive explanations that cleared their doubts about participating.

5.8.2 Conducting interviews

Because of formal requirements and the peculiar safety risk situation of two of the selected case studies (Enugu and Port Harcourt), which was revealed during the pilot study, steps were taken to ensure the safety of the researcher and his assistants.

Table 5: Focus groups (FG) and key informants (KI) for the study

Job Designation	Organisation	Activity type and frequency
Director	Monitoring Department	KI interview: 1 interviewee
Manager	Oil Company	KI interview: 1 interviewee
Union Leader	Oil Company	KI interview: 1 interviewee
Operative	Anti-Corruption Commission	KI interview: 1 interviewee
Prosecutor	Anti-Corruption Commission	KI interview: 1 interviewee
Union Leaders	Tanker Drivers' Association	FG: 5 expected and 5 Turned up
Community Leaders	Local Community	FG: 5 expected but 4 turned up
Community Leader	An oil producing community	KI interview: 1 interviewee
Community Leaders	Community in Abuja	FG: 5 expected but 3 turned up
Transport Officer	Local Government	KI interview: 1 interviewee
Director	Emergency Department	KI interview: 1 interviewee
Community Leaders	Community in the southern region	FG :15 expected but 45 turned up
Inspector	Investigation Unit	KI interview: 1 interviewee
Officials	Local Government in Abuja	FG: 5 expected and 5turned up

Source: Fieldwork, 2009.

The process of conducting interviews is set out in four successive steps: identifying the interviewees, approaching the interviewees, conducting the interviews and transcription. These four steps in conducting interviews are discussed in detail below.

5.9 The focus group and the key informant interviews

Identification of key informants and other subjects to be interviewed is vital for collecting the needed quality of data from each of the four case studies. Given the complexities of the issues of petroleum pipeline management and the incessant cases of vandalism, finding out which organisation and community should be visited during the conduct of the fieldwork became essential in order to identify credible interviewees and focus groups for the study. In this regard, the researcher's expert knowledge derived from years of work in government service and particularly, in the planning and development control departments, was useful in identifying key informants to be interviewed. This experiential knowledge of the researcher was also useful in identifying the case studies themselves and enabled the researcher to identify both key people with requisite knowledge and key communities with a history of pipeline vandalism.

5.9.1 The focus group

Ten focus groups were planned for the fieldwork. However, security considerations constrained the researcher to carry out only five in the three month duration of the fieldwork.

The first focus group was conducted in the southern community notable for vandalism of the pipeline that traversed it. The researcher was accompanied to the first focus group meeting by a plain clothes policeman who also acted as a key informant for the fieldwork. The key informants had hinted to the researcher that the pipeline in this community had consistently been vandalised, hence the decision to discuss vandalism with stakeholders in the communities. The community is made up of about 57 identifiable social groups that pride themselves as the stakeholders of the community. The researcher decided to have representation of one member each from the social groups in the focus group for this community. As a result, the 15 people

were expected in the focus group. However, the social groups insisted on having three representatives in the focus group, a development that meant that 45 people turned up and all insisted in being part of the discussion.

Some of the interests represented in the focus group were age-related, including the representatives of people born in the same era who had profoundly influential voices in the community. This is because, unlike other interest groups in the community, those relating to age are seen as the most representative of community interests and have membership cutting across all social strata. Because everybody in the community belongs to one age group or the other another, their opinion is highly regarded. The age groups in the community act as the defenders of community interest. The people in the community owned up to vandalism and said they will continue to vandalise the pipelines so long as there cannot procure petroleum products through legitimate means.

Another influential group of stakeholders in the community is the community council of elders. They act as the custodian of the people's traditions. This group is the appropriate administrative authority, with a mandate to mediate in intra-community and inter-community conflicts. The council of elders also acts as the rallying point for community interests. Membership of the council consists of only male representatives from the different clans in the community. Each representative canvasses the interests of the clan he represents. The community council of elders is headed by the community chief. Once appointed, the community chief remains in office for life, except when deposed on grounds of insanity or misconduct by the Governor of the State.

Another interest group is the women's group, which is made up of only female members of the community and was headed by the first wife of the community chief. The women's interest group have very persuasive opinions on issues affecting the community. They act as a pressure group that speaks out mostly on issues that affect women and children in the community.

The meeting in the community started at 11am and lasted for four hours. The younger people in the group threatened the researcher with violence because they suspected him to be an agent of the state who had gone into the community to collect

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information about the possible involvement of its members in cases of vandalism. The key informant, who also acted as gate keeper in the community, invoked the intervention of the community head, with whom he had worked previously on pipeline-related investigations, to bring the tense situation under control.

Another focus group discussion was held in an oil producing community in the Niger Delta region of the country. The focus group was held with community members and security forces involved in maintaining law and order in the area. The focus group was comprised of four members of the armed forces and five members of the community.

Discussion started at 12 noon and was slated to last for four hours, but was interrupted by the activities of militants who invaded a site nearby and kidnapped a member of the public. The confusion that ensued led to an abrupt end of the focus group half-way into the deliberations. The researcher was evacuated to safety by the military personnel and was told that the whole of the area was "infested with kidnappers" who patrol the creeks and that many of them had informants in hotels in the town. Beyond the focus group, the military personnel provided security cover for the researcher throughout the other stages of the fieldwork activities in the area. On this occasion, the researcher came close to being kidnapped in the Niger Delta area.

The third focus group was held in the major petroleum product distribution depot in the eastern part of the country, with members of the Petroleum Tanker Drivers Association in the region. There was no immediate threat of insecurity in the area because the premises were fenced round and protected by the Nigerian Police. The focus group lasted for three hours and the executive members of the association, numbering 12, attended. The Tanker Drivers Association executive members spoke on the issue of pipeline vandalism from the perspective of the economic impact on the country, due to the wastage of the vast network of pipeline in the country that cannot be used for petroleum products transportation because of vandalism. They also stated that petroleum products that used to be transported through the pipelines are now transported on the roads by the use of tankers over long distances. They said that the pressure exerted on the roads as a consequence has meant that several sections of the road have become unviable.

The fourth focus group was held in the North Central region with community members composed of seven youth leaders and three elders. The youth group, representing the active group in the community, along with the elders, gave a historical account of the pipeline in the community. The youths were aged 18-40 years. Most of them lamented the environmental effects of pipeline vandalism on the people in the area and talked about issues ranging around poverty, unemployment and disease in the community as a result of vandalism. They also talked about the destruction of farmland and property and restated their community's expectations that compensation for the land taken for the pipeline project would be paid to them.

The fifth focus group was also held in the north central region with community members and leaders of a local council. The community elders in the focus group were four and the council members were seven. One of the community elders was a chief executive officer of the council when the problem of vandalism was at its peak in the area. He gave a historical, administrative and procedural account of the problem of vandalism locally. Other members of the community who came with him only endorsed what he said. Asked if they had anything to add to his account, they said that the account of the former chairman was authoritative and entirely reflective of the problem in their community. The council officials gave an account that not only corroborated the account of the community leaders but also provided the researcher with a gatekeeper who accompanied him for the duration of the other activities involved in the fieldwork in the area.

5.9.2 Approaching the participants

After identifying the interviewees for the study, the next hurdle was how to secure their involvement and cooperation in the interview process (Flory and Emanuel, 2004; Morgan, 1996). Having access to interview key informants is very difficult, especially in a society that is highly fragmented along ethnic and religious lines like Nigeria. As is case with most fieldwork in developing countries, some of the informants exhibited high levels of scepticism as to the identity and motives of the researcher (Okediji, 2005; Osaghae and Suberu, 2005; Ilesanmi, 2001). Although the researcher, before going into the field, had attempted to reach-out to most of the organisations and communities visited, using his vast network of contacts developed over the years, this did not make the encounter with participants an easy task. Many

of the key informants asked the researcher to come back again and again before finally granting an audience.

The researcher had to secure the services of gatekeepers in many of the organisations and communities visited (Agada, 1999). To play the role of the gatekeeper, a person has to command political, academic or community respect and reputation. In order to shield the research from political pressure and manipulation, the researcher opted for academic mentors and community opinion leaders to serve as gatekeepers for the research. This option worked well, allowing the researcher to conduct the scheduled focus group interviews and also record a 98% completion rate for the structured interview questionnaires. The gatekeepers were very instrumental to the success recorded by the researcher in the task of using the global positioning unit to capture ground control points on the pipeline over a distance of 23km from Kwali to Abaji in Abuja, the Nigerian Federal Capital Territory. They accompanied him throughout the task of capturing ground control points using the GPS.

5.9.3 Conducting the key informant interview

The key informant interview employed a technique based on the prescription of Bryman (2008) interview framework. The key informants as shown in table 5 above cut across a range of stakeholders ranging from officials and union leaders of the national oil company, community members, officials of the departments of monitoring and emergency services to staff members of the local governments in the case study areas. This is because the framework provides the opportunity for the researcher and the interviewee to interact personally with each other. To avoid language misunderstandings, the interviews for this study were all conducted in English. This helped in no small way in the eventual transcription of the interview data, because the researcher did not have to go through translation from other languages to English as a prelude to the final transcription exercise (Mandel, 2003). The process for conducting each interview was designed to follow three steps:

    i.   Pre-interview; ii.
    ii.   Interview; and iii.
    iii.   Post interview.

The interview schedule is diagrammatically illustrated in appendix 2. Following this routine, each interview began slowly with preliminary talk as an icebreaker, to

introduce the topic. The conversation started gradually thereafter in a manner so as to gain the confidence of the interviewee prior to the confidentiality declaration. The researcher followed this up by introducing the subject matter of the interview and delivering the questions one after the other. With this procedure, the interview process ran its course successfully. At the end of each interview, the interviewer asked the permission of the interviewee to have recourse to follow-up by email or phone if the need arose and all the interviewees obliged. The elaborate preparations made before going into the field impacted positively on the whole process of the interview. The supervisory team gave unflinching support to the researcher. They wrote several letters introducing the researcher to the various organisations and communities using the University letterhead. This gave credence to the exercise because of the officious nature of Nigerian society. The processes leading up to the interviews created some element of trust between the interviewer and the interviewees.

The interview process also developed a bond of friendship between the interviewees and the researcher such that a few of them called the researcher to volunteer further information that became available to them after the interview process was completed. This helped the researcher to update data collected.

5.10 The Structured interview questionnaires

Administration of the structured interview questionnaires was done with the assistance of two research assistants from the Federal University of Technology in Yola, Nigeria. The two research assistants were trained for two weeks in Abuja before the commencement of the fieldwork. Each question on the questionnaire was explained and interpreted to the research assistants so that they could explain to the respondents from the perspective of the researcher if the need arose. Other topics covered during the training were:

1. Health and safety in the context of the four case studies;
2. How to approach respondents in the volatile and non-volatile case studies; and
3. Use of a digital camera, camcorder and the global positioning system.

5.10.1 Identifying the respondents

Two households were randomly selected at one point of entry of the pipeline into the community as a reference point. The two households selected were 20 metres away from each other, to avoid a situation where the households selected on either side of the pipeline would be directly opposite one another all through the sample area. From these reference points, every other fifth household on either side of the pipeline was selected and the first household member aged 18 years and above was selected as a respondent.

5.10.2 Administration of questionnaires

In Abuja, 139 structured interview questionnaires were given out to respondents to be completed for collection the next day. At the time the questionnaires were collected, about 50 of the respondents were not found in their houses. However, after repeat visits, 38 more completed questionnaires were collected, bringing the total number of the questionnaires not returned to 12. Those who returned their completed questionnaires after repeat visits attributed their inability to keep to the initial appointments to their agrarian occupation, which according to them meant that their movements were not predictable. Some of them said that they went to their farm and had to stay on the farm for days, attending to farm produce that was in danger of being burnt by fires caused by pipeline vandalism. However, some of the non-responders were not contactable to learn their reason (s) for non-return of the questionnaires.

As a result of the experience in Abuja, questionnaires were subsequently administered and collected the same day. The researcher and research assistants stayed with the respondents as they completed the questionnaires and this afforded them the opportunity to explain to the respondents any questions that they were not confident they had understood. This questionnaire administration strategy proved very successful because 100% rates of return of completed questionnaires were recorded in the remaining three case studies. In Otukpo, 146 questionnaires were administered, 135 in Enugu and 168 in Port Harcourt. Further discussion on questionnaires of questionnaires is done in section 7.3 (Return of completed questionnaires).

5.11 Gate keepers

Because of the peculiar security situation revealed during the two pilot studies, gate keepers were identified in each of the case studies. The gate keeper in each of the four case studies, who was also a native of the area, accompanied the researcher and his research assistants. Where there was suspicion as to the true identity of the researcher, the gate keeper explained to the community members in general and the respondents in particular that the researcher was genuine and that information given was going to be treated with the utmost confidentiality. The gate keepers also provided local intelligence to the researcher during the fieldwork and were committed to the safety of the researcher all through the survey period.

5.12 Data transcription

In academic research, data obtained through interview can only be useful if it is transcribed. As already mentioned above, transcription of interview data and coding of the collated data from the structured interview questionnaires into the Statistical Package for Social Scientists Software was one of the important post-fieldwork activities carried out by the researcher (McLellan et al., 2003; Hycner, 1985). The researcher transcribed the key informant and focus group data immediately after the scheduled interviews for any particular day were completed. This was done so that all information gained from the day's interview was properly recorded and transcribed while the memory of the day's interview engagements was still fresh. Collation and coding of information from administered interview questionnaires was done by the researcher after completion of the exercise.

5.13 Direct observation

Observation can be carried out in a number of ways. There are direct and indirect ways of observing events or phenomena, and non-participant and simple observation (Hartley, 2004). Direct observation, which is called non-reactive observation, is carried out in such a way that the researcher does not get involved in direct elicitation of information from the research subjects (LeCompte, 1999; Sigman et al., 1988). Direct observation was strategically used by the researcher to obtain data at various pipeline vandalism sites in the four case study areas and Lagos during the

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fieldwork. This data collection technique was used by the researcher mainly for mapping and geographic information systems data collection. It was also used to acquire digital images of contaminated farm lands and water bodies in the case study areas.

However, the disadvantage of this technique is the high risk of being misunderstood by the communities in which the direct observation exercises take place. During the field work, the researcher was mistaken for a secret service agent on an investigative inquiry mission, who could implicate the communities and some of their members in the numerous vandalism incidents which are classified as criminal offences by the provision of the law in Nigeria (National Assembly Nigeria, 1990e). This difficulty was, however, overcome by the intervention of the gatekeepers, who were also around at the time of the fieldwork to identify and explain the research motives of the researcher whenever members of the community become suspicious and apprehensive of the researcher's observational activities.

5.14 Data collection techniques

Following the mixed method approach for the research, there are several methods of collecting the data (De Leeuw, 2005; Johnson and Turner, 2003). The case study approach for the research also meant that it needed to rely on a variety of sources as opposed to being limited to a single source (Yin, 2008). Considering the case study focus of the research, multiple sources of data from both primary and secondary sources were used (Sapsford and Jupp, 1996). To ensure that the chosen method was adequate to answer the research questions in consistency with the research strategy examined earlier in this chapter, this study employed various techniques to obtain data from primary and secondary sources.
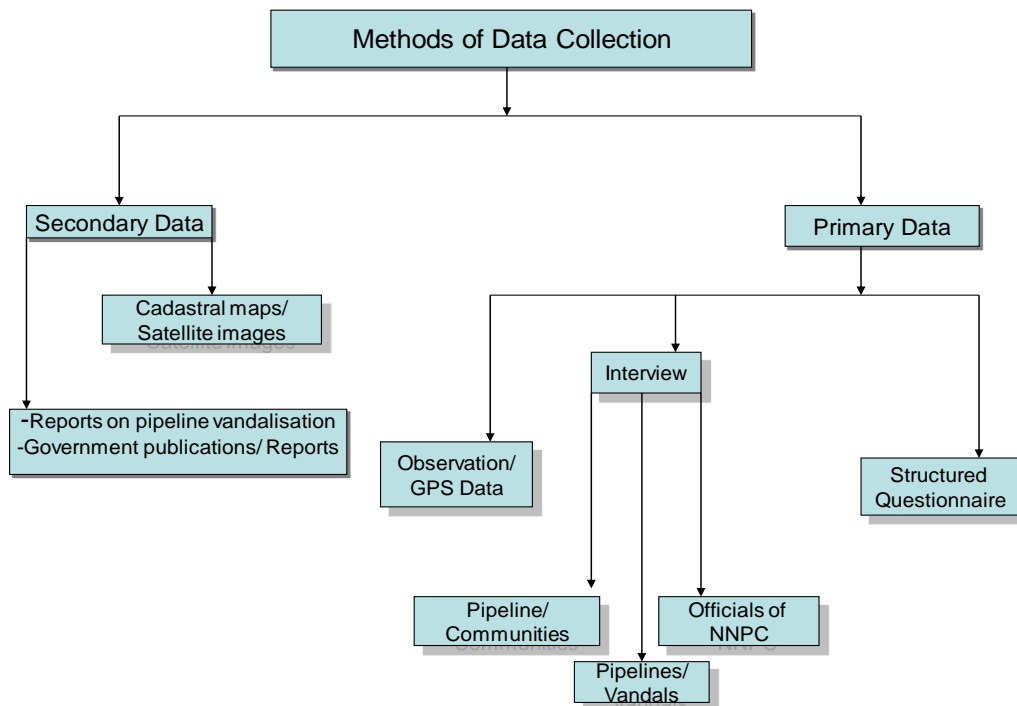
Figure 7: Data collection processes

As seen in figure 7, primary data were generated from the administration of questionnaires, focus group interviews, the use of key informant techniques and observation. In addition, digital gadgets such as the camera and the global positioning system were used to generate mapping and terrestrial data. Secondary data were sourced from published official documents, statistics, and corporate disclosures by oil and gas companies. Other secondary sources of data include host community development plan frameworks, national laws having to do with the network of pipelines and its ROW and the Niger Delta Development Master Plan (Wheeler et al., 2003). The resulting data were variously treated and synchronised for both quantitative and qualitative analyses (Bryman, 2008; Tambunan, 2006; Esrock and Leichty, 1998).

Analyses of documents from secondary sources is widely used for various kinds of environmental research (Hentschel et al., 2000; Bourgeois Iii, 1980). According to Yin (2008), documented secondary data can be in the form of communiqués, archival records, administrative documents and computer files and records. This

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research, however, used policy documents, corporate websites, published official documents and journal articles as secondary data for the research. These data were analysed using the instrument of content analysis, the result of which fed directly into the research findings.

Observation has been a valid technique of data collection in the social sciences through the 20th century to the present era of social science research (Barker et al., 2002). Observation was also used as a means of data collection, as the study is focused on a situation in which the observer has no influence or control over the behaviour of the research subjects but only plays a passive non-intrusive role in the research situation (Barker et al., 2002; Bogdan and Biklen, 1982). The use of observation permits a lack of artificiality and reactivity in the data gathering process and enabled the researcher to garner precise and reliable information about naturally occurring events (Bailey et al., 1995; Bailey and Gatrell, 1995; Bailey, 1991). Observation was adopted in the research to complement the data generated from other primary and secondary sources.

There are different types of research interview. However, in the case study strategy employed in this research, the most recognised types are the open-ended/unstructured interviews, the focused/semi-structured interviews and the structured interviews (Bryman, 2008; Yin, 2008). It was perceived that one of the most reliable sources of information for the researcher was the unstructured or open-ended interview (Jarratt, 1996; Barriball and While, 1994; Coreil, 1994). It is particularly useful in enabling researchers to probe deeper and also solicits robust responses; hence, it uncovers hidden details that observation and other primary data collection techniques may not discover. The unstructured or open-ended interview technique is a relatively informal technique that usually involves two or more people in a conversation or discussion over a range of questions. Unlike the typical question-answer (structured interview) format, open-ended interviews generate mostly qualitative data (Ten Have, 2004). They create more interaction between the researchers and the informants, making the ensuing interaction highly attractive for qualitative data collection (Bryman, 2008).

The open-ended interview which was adopted for the key informants in this study gave the interviewees the opportunity to talk freely about the issues raised during the

interview. However, this technique has been criticised as very complex and difficult to control (Bryman, 2008). It is therefore risky to adopt the technique as the sole means of primary data collection, hence the use of other primary data collection instruments such as observation, mapping and questionnaires.

The structured questionnaire interview is a standard formal survey technique ideal for answers formulated in the form of options such as "yes", "no" or a score in a linear scale, that is, in an a, b, c or 1, 2, 3 manner and can be undertaken in person or mailed to the respondents (Bryman, 2008; Yin, 2008). This type of interview is more likely to produce quantitative data. As has already been mentioned in the preceding section (data collection techniques) , it is suitable for this study because it facilitated the collection of the bulk of the quantitative data that complemented the qualitative data collected with the use of the key informant interview and focus group discussions. The focus group interview was characterised by a guided discussion. Although the researcher pursued a consistent line of enquiry in this kind of interview, the stream of questions is likely to by fluid as opposed to being rigid (Simpson and Humphrey, 2010). Throughout the interview process, it remained open-ended and assumed a conversational manner, while still strictly following the underlying research protocol (Sim, 1998; Lederman, 1990; Seidler, 1974).

5.14.1 Spatial data collection

The pilot study showed that a considerable proportion of the pipelines, most of which were laid over four decades ago, had been covered over by human settlements and vegetation. Preliminary findings revealed that the loss of the path taken by the pipelines in many parts of the country was a major challenge in the management of the ROW, hence the need to demarcate and rediscover it through the application of geographic information systems. Linear mapping was done using the global positioning system (Dauwalter et al., 2006; Allison et al., 1998).

The use of the GPS in stream habitat studies has shown that measuring stream habitats with GPS would result in spatially referenced data that allowed the assessment of relative habitat position and changes in habitats over time, and was often faster than using a tape measure. This goes to show how human activities have operated over time to compromise the pipeline routes in Nigeria, causing

encroachments on the ROW in spite of the statutory stipulations for their protection because there is no mechanism in place to alert the authorities to the encroachments. For most spatial scales of interest, the precision and accuracy of GPS data are adequate and have logistical advantages when compared to traditional methods of measurement. They also have real-time advantages for monitoring spatial and temporal phenomena.

It has been reported that measuring features with a GPS receiver was up to 3.3 times faster on average than using a tape measure, although signal interference from high stream-banks or overhanging vegetation occasionally limited satellite signal availability and prolonged measurements with a GPS receiver (Lambert et al., 2007; Dauwalter et al., 2006). Experiments have also shown that there are no differences in precision of spatial dimensions when mapped using a continuous versus a position fix average GPS data collection method (Tedrumpun and Nakapan, 2004), thus using the handheld GPS unit to generate a stream of ground control points would result in the appropriate demarcation of the lost routes of petroleum pipelines in Nigeria.

For the present study, following on from the analyses of the utility of the GPS above, a 23km length of the pipeline was identified in the Federal Capital Territory, Abuja, Nigeria, over which the GPS was used to generate ground control points which were used to re-establish the routes taken by the pipelines from Kwali through to Abaji within Abuja. This stretch of the pipeline route in Abuja was used as a template for re-establishing the lost pipeline routes across the country.

A GPS unit was connected to a Dell laptop using the NMEA protocol. Walking through the 23km of pipeline route from Kwali to Abaji, a stream of GPS coordinates were acquired and transferred into the laptop and then stored in a vector file. After the fieldwork, the vector file was opened and replayed using the Geographic Information Systems (GIS) and AutoCAD software. This operation automatically resulted in the vector file being plotted and thereby showing the route taken by the pipelines in Abuja. Activating the buffer tool in the GIS, a 50m buffer depicting the statutory ROW of the pipelines was created along the pipeline route (National Assembly Nigeria, 1990d). This action resulted in the highlighting of an area 25m to the left and 25m to the right of the pipeline.

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A geo-referenced satellite image of the area is then added as a layer. By overlaying the 50m buffer on top of the satellite image, the ROW of the pipeline across the 23km length from the ground control points acquired would automatically become obvious on the satellite image. Physical development layouts and topographic maps covering the area were then acquired, scanned and geo-referenced. An on-screen digitising technique was then used to digitize the physical development layout plan and the topographic maps using a value domain to create a vector data. The vector data created by digitising the layouts and maps was converted into a raster format and interpolated. This action resulted in the creation of a digital elevation model. The GPS coordinates depicting the routes of the pipeline were then plotted on the digital elevation model to reveal activities and other land uses that may have encroached on the ROW in the case study.

5.15 Data analyses strategy

Adopting an appropriate analysis strategy for case study evidence according to Yin (1993) has always been difficult because the study is continuing to evolve. He does, however, prescribe three analytical strategies for data generated from case study research. These are:

i. Relying on the theoretical propositions that led to the research questions, aim and objectives;
ii. Examining rival explanations on the research theme; and
iii. Developing a case explanation.

According to Yin (1999), using the theoretical propositions is the approach most commonly used for analysing evidential data in case study research. This strategy is adopted for the case study based on the theoretical underpinning explained in chapter two. It provides a guide for recognising data that has direct relevance to the purpose of the research. It is a strategy that helps the researcher to sieve and discard irrelevant data as a quality check for data integrity and general quality assurance in the case study research process. This strategy has been found to be especially useful justifying the aim and objectives in case study research (Darke et al., 1998). This strategy is very useful in analysing data collected for this research because it is amenable to the statistical, content and terrain analyses underpinning this study.

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The strategy of thinking about rival explanations is useful for research that is only qualitative (Bryman, 2008). This is because it can only be applied to textual data analyses, in a manner similar to content analyses (Yin, 1993). Because of its exclusively qualitative attribute, it was not suitable for this research, which employs a mixed method approach.

Developing a case study description, that is, where the research seeks to develop a descriptive framework for analysing and presenting the case study evidence, is usually adopted as an alternative strategy when the case study does not fit into the other two methods of data analyses (Mays and Pope, 1995). In practice, however, this method of data analysis is less attractive than the first two. It is mostly used in situations where the first two are found to be inapplicable.

In analysing the quantitative data from the case studies, single absolute percentages are reported in data sets where this is the only important information shown in a figure. This strategy proved very important as it enabled the eliminate tables that did not present more than one significant outputs.

5.16 Drawing conclusions

Drawing conclusions is an important aspect of data analyses activities. Much mixed method research has considerable difficulties in drawing conclusions (McKendrick, 1999; Wood et al., 1999). This is particularly the case when conducting social research that employs the case study strategy. According to Bennett (2002), the combination of new themes of research, the broadening scope of methodologies, and greater specialisation within sub-fields has overshadowed the common methodological concerns of researchers in many social fields. Bennett opined that when conducting direct observations in different case study contexts, one of which might be more familiar to the researcher, care must be taken to avoid the bias of the more familiar case study as a basis for the interpretation of the other case studies. According to him, this might affect the validity of the conclusions drawn from the study.

Drawing conclusions in case study research entail looking for patterns in activities, meanings, and forms of participation, relationships and settings. The search for

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meaning in the form of valid conclusions that reflect the research aim and objectives is often through a chain of activities involved in a search for patterns, which implies selecting categories or dimensions through which to seek within-group similarities coupled with inter-group differences. In order to draw reliable conclusions, a mixture of analysis techniques should be used to strategically interpret the research results in line with the research (Bhattacharya, 2008). The researcher in this study adopted different approaches to interpret the evidence derived from the data analyses. Before any final conclusions were drawn, the researcher looked through all forms of documents and other original data acquired and their transformations through the research process. If differences were noticed; the places where these new insights emerged were traced and re-read. This was also followed by revisiting and updating the research aim and objectives. By doing this, the researcher tried to ensure that the conclusion reflected the flow of argument through the whole thesis.

5.17 Limitations of the research method

Despite the details presented in the design process for this research, some limitations were still perceived in the course of the study. These limitations are highlighted below.

It would have been helpful if the researcher had been able to interview the non-nationals involved in the act of vandalism in Nigeria, some of whom had already pleaded guilty to this crime and were serving different jail terms. This would have given insight into the international dimensions to the problems of pipeline vandalism. However, the researcher was not able to secure approval to talk to the foreign vandalism cohort in order to unravel the motives behind their involvement. Another limitation is the inability of the researcher to conduct a complete census of all the relevant stakeholders in the research context. This would undoubtedly have revealed more information, going beyond the revelations of the case studies as actually carried out (Schlesselman and Stolley, 1982). The case study is, however, still justified, because it is impossible to conduct a census survey for a doctoral research project due to time and resource constraints.

Secondly, the participants were mostly stakeholders in the pipelines and their associated ROW and the oil and gas industry generally. Information from non-

stakeholders would have given insight into the thinking of those who could not be classified as oil and gas stakeholders with regard to the problem studied. This chance was hopefully reduced by the adoption of documentary evidence and the base data captured using satellite technology. Thirdly, due to the case study research design, the data acquired greatly reflected the peculiar uniqueness of the character of the case studies selected. This might have constrained the data, since Nigeria is socio-culturally very diverse and behaviour may vary across its over 250 ethnic groupings (Ibelema, 1992; Schwarz, 1965).

5.18 Chapter summary

In this chapter, it has been explained why the case study was chosen as the research approach. The reason for the selection of the mixed method case study design as the appropriate method for data acquisition and analysis has also been explained in this chapter. Drawing on the methodological literature, the chapter discussed why the multiple case study design is best suited to achieving the research aim and objectives. Building on the mixed qualitative and quantitative methodological assumptions in conducting case study research, this chapter gave a comprehensive description of how multiple data collection methods as employed in the study fit well with its research questions.

Details of the approach to data collection and analysis were presented in comprehensive detail in order to give the reader a clear understanding of how the research was carried out. Furthermore, the discussion of data collection and analysis focused on the problem of pipeline vandalism, with implications for the causative factors and the environmental, social and economic externalities in the pipeline communities. This provided critical awareness of information on the pipeline management problems in the Nigerian context for national and international readers. The chapter ends with a reflection on the methodological limitations of the research. This is of particular use in supporting the researcher in dealing with methodological issues in future research. It will also help other researchers who may want to adopt the methodological approach taken in this research with a view to avoiding the limitations that have been highlighted.

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CHAPTER 6

DEMARCATING THE ROW OF PETROLEUM PIPELINES

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6.1 Introduction

Petroleum resources produced in the Niger Delta region are in demand both in the region and in other parts of the country and for export internationally. Consequently, to meet in-country and export demands, several lengths of pipeline have been built and many others proposed as new oil fields are discovered (Agbazie, 2004). As mentioned in chapter one, laying of pipelines for transporting petroleum products statutorily creates a buffer over the pipelines known as the ROW of the petroleum pipeline (National Assembly Nigeria, 1990d). The ROW of a petroleum pipeline is the 50m buffer across the pipeline within which other uses are not permitted (Brume, 2007). Though statutorily protected, the ROW has been variously encroached upon by human settlement and other activities, resulting in damage to sections of pipeline in various parts of the country. This has sometimes been attributed to a lack of thorough demarcation of the pipelines across the country. In one such incident, an earth moving machine encountered a petroleum product pipeline, which resulted in a large scale explosion causing widespread destruction of lives and properties (Orji et al., 2008). Non-demarcation of the ROW, over the five decades after pipelines first began to be laid, has led in many parts of the country to a loss of positional identities, which has implications for their management.

6.2 Encroachment on the ROW and avoidable disasters

As stated in chapter one, with a length of about 7,000 km traversing the length and breadth of the country and a width of 50m (Agbazie, 2004), the petroleum pipeline ROW account for a major use of land for which an effective management framework is still not in place (Chukuemeka and Amuezeuoke, 2005). This is in spite of the fact that the ROW of petroleum pipeline in Nigeria is statutorily protected and legally prescribed as void of activities outside routine maintenance (National Assembly Nigeria, 1990d).

Figure 8: Showing a stretch of oil pipeline covered by vegetation

Source: Field Work 2009

As seen in Figure 8, natural processes have acted over the years to restore vegetation cover on the land traversed by the pipeline, making it less visible. Avoidable loss of life, property and grave damage to the environment (Onuoha, 2007) have often occurred accidentally on the ROW because it has not been demarcated and so not properly monitored. This thick vegetative cover also provides a layer of concealment in the cases where damage is wilfully inflicted by vandals.

Adequate concern has not been given to the long term management of the ROW and, by implication, the petroleum pipeline itself, during and after the design and construction phases, exposing this very important national infrastructure to man-made and natural hazards (Porter and Savigny, 2002a; Porter and Savigny, 2002b). The havoc wreaked on the pipeline has often been carried out in order to siphon off the products it transports. Community members scavenging for the spoils of organised acts of vandalism have in many cases become caught up in explosions causing loss of life and property with serious environmental costs (Onuoha, 2008c). Demarcating the ROW will make the tract consistently visible and traceable across the country. This action will create the platform for implementing a real time monitoring programme against vandalism and further encroachments. As reported by

Lukowski *et al.* (2004), unauthorised activities remain the leading cause of all pipeline failure. This research has confirmed that damage caused by unauthorised activities could be quantified in millions of dollars, in addition to the near irreversible environmental costs and loss of life in its wake.

Figure 9: A dwelling unit encroaching on a pipeline

Source: Field Work 2009.

As illustrated in Figure 9, human settlements have also encroached on the pipeline network in many parts of the country, creating the setting for two-fold disasters. The occupants of the houses that encroached on the pipelines are faced with the prospect of possible explosion if the pipeline fails because of age and rust or when vandalised. On the other hand, encroachment on the ROW hides the pipelines away from the public view which can serve, in the absence of formal surveillance, to ward-off vandals or detect ruptures due to natural processes over time.

The communities affected in most cases sprang up long after the pipelines were laid, and hence the endangered people who dwell in the settlement may not be aware of the existence of pipelines in their neighbourhood (Odoh and Iyi, 2005). In the event of explosions caused either by natural causes or acts of vandalism, houses built within the ROW have always been the most affected in terms of damage (Clement-

Ogbuanu, 2008). The usefulness of the pipelines has been impaired by encroachment and vandalism, with implications for their intended economic and social benefits to the country.

The problems have become so incessant that the very essence of the pipeline option for petroleum products transport is going out of use gradually in the hinterland. Nevertheless, the pipelines still present the most efficient, safe, environmentally friendly and economic way to transport petroleum products (Dey, 2003).
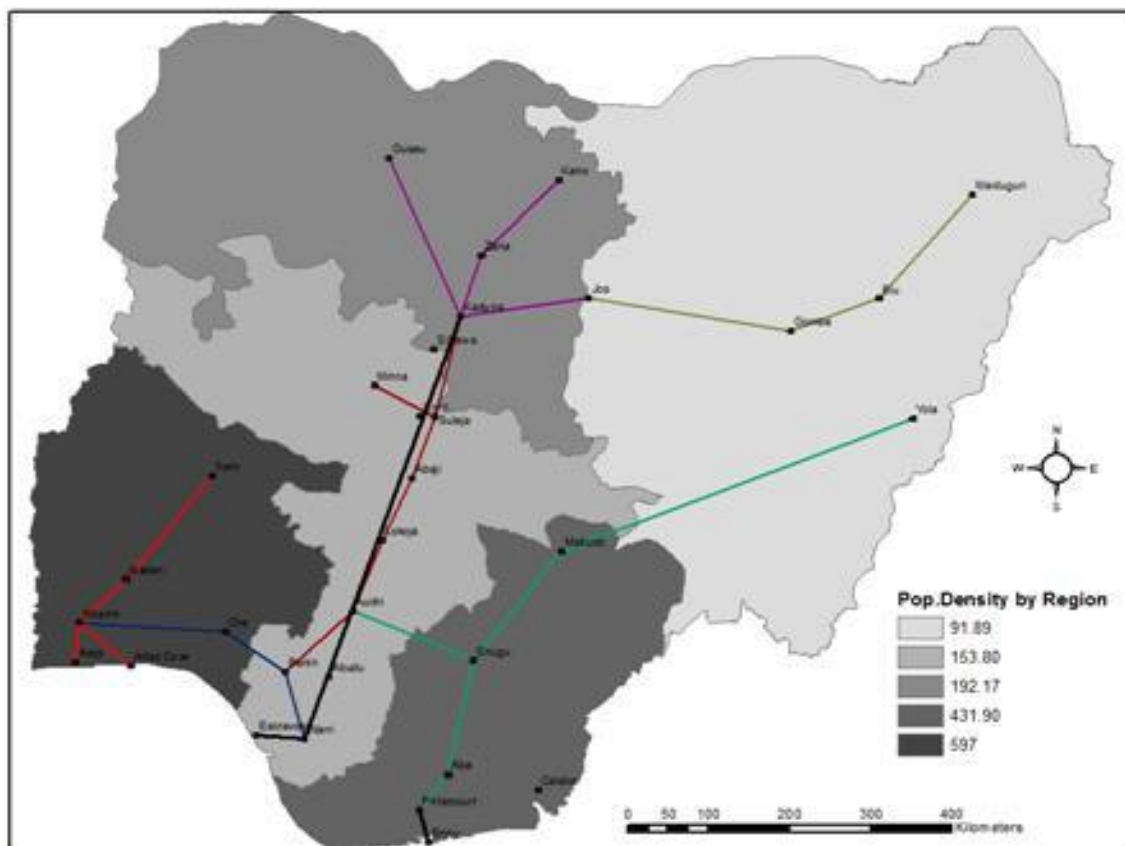
Figure 10: Map of Nigeria showing population densities along the ROW

Source: Fagbeja 2008

Historically, the route taken by the pipeline is closely associated with the communication routes developed by pre-colonial trade activities and colonial powers in Nigeria (Agbazie, 2004). This is because the communication routes originally created by the colonisers connected major towns that have since developed to

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become major cities, with a high demand for petroleum products. As seen in Figure 10, the route taken by the pipeline network and the distribution depots is associated with areas of high population density across the regions. Notwithstanding the primary aim of product distribution across the country through the pipeline network, this study finds that vandalism has made it impossible to transport products through the pipeline and, as a result, the bulk of petroleum products are now transported by trucks. This research further finds that transportation of petroleum products by road has contributed significantly to the problem of bad roads in Nigeria because the roads were not built to withstand the extent of pressure exerted by trucks conveying petroleum products from one point to another for consumption.

Pipeline construction and operation were found to have caused damage to soils, surface and groundwater, air quality, vegetation, wildlife, and fish populations. Product leakage and seepage is another major cause of environmental issues across the case studies (Onuoha, 2007; Van Hinte et al., 2007). Responsibility for the processes leading up to the construction, operation and the associated maintenance of the ROW is the exclusive jurisdiction of the central government, which as presently constituted, lacks the machinery for their effective monitoring and maintenance (Fagbohun, 2005).

Figure 11: Damaged pipeline explosion in Lagos, Nigeria.

Source: Source: The Sun Newspaper, Nigeria 16/5/2008

As seen in Figure 11, civil works encountered the petroleum pipeline in Lagos, causing large scale destruction because the ROW were not demarcated and made visible on the ground. This caused explosions and manifold loss of life, property and severe damage to the environment (Soyinka, 2008). The communities in the midst of these pipelines live in extreme poverty (Sangoloye, 2009; Ndumbe, 2002). As Sangoloye (2009) averred, the mostly poverty stricken youths in the pipeline communities cited struggle for subsistence, and so they turn to stealing oil from the damaged pipeline. As this study shows, many communities situated near the pipelines find it difficult to resist the temptation of seeking subsistence from the pipelines because of their extreme poverty. This they have done even at the risk of losing their life and property in the process. There have been reports of deaths in large numbers due to pipeline destruction (Arubi and Oyagongha, 2008), with the incidence still continuing unabated. In most cases, the vandalism, damage to the environment and loss of life have not deterred the perpetrators (Nwilo and Badejo, 2006).

Figure 12: Pipeline explosion due to vandalism

Source: Fieldwork 2009

Many explosions owing to vandalism have been recorded in Nigeria in the past ten years (Arubi and Oyagongha, 2008). As seen in Figure 12, these explosions have damaging implications for the environment, petroleum product supply and also account for significant national economic loss, because Nigeria is a mono-product economy that derives over 80% of its national revenue from the oil and gas sectors (Nwilo and Badejo, 2006). Besides these losses, many lives have also been lost to pipeline explosions caused by vandalism. Demarcating the ROW is therefore essential because they have been substantially lost in many parts of the country. A GIS template for national application for demarcating the ROW is thus necessary and is the first step in the series of activities leading to the development of a management programme that will bring various pipeline stakeholders together in a collaborative framework that will not only reduce the problem of vandalism to a minimum, but will also be useful in detecting product leakage from the pipeline before it degenerates into environmental disaster. A successful design and implementation of this GIS template could also have implications for similar pipeline problems around the world. A template for demarcating the ROW is therefore presented below.

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6.3 Demarcating the ROW

A length of the petroleum pipeline measuring about 23km from ground control points co-ordinates X=274478.000 Y=972833.000 Z=0.000 in Kwali Council Area to ground control points co-ordinates X=272706.136 Y=934045.994 Z= 0.000 in Abaji Council Area, all within the Federal Capital Territory of Nigeria, was selected for the purpose of using geographic information systems to demarcate the lost route of the pipeline. Thereafter, the global positioning system (GPS) unit was used to capture ground control points (GCP) at each of the points at significant strategic intervals along this length of the petroleum pipeline in Abuja.

The GPS unit was thereafter connected to a laptop computer using the National Marine Electronics Association (NMEA) protocol. The route of the pipeline from Kwali to Abaji was then followed to capture and transfer a stream of acquired GPS co-ordinates into the laptop computer, storing it in a vector file. This action generated the following data which was used to plot the route taken by the pipeline.

Table 6: Ground control points 23km distance from Kali to Abaji in Abuja

```
at point X=274478.000 Y=972833.000 Z=  0.000        at point X=270026.719 Y=950133.982 Z=  0.000
at point X=274405.000 Y=971998.000 Z=  0.000        at point X=270388.719 Y=948843.982 Z=  0.000
at point X=274356.000 Y=971413.000 Z=  0.000        at point X=270716.765 Y=947672.820 Z=  0.000
at point X=274264.000 Y=970430.000 Z=  0.000        at point X=271073.784 Y=946408.751 Z=  0.000
at point X=273420.000 Y=963370.000 Z=  0.000        at point X=271493.784 Y=944925.751 Z=  0.000
at point X=273105.000 Y=962752.000 Z=  0.000        at point X=271873.804 Y=943587.680 Z=  0.000
at point X=272864.000 Y=962258.000 Z=  0.000        at point X=272017.805 Y=943080.678 Z=  0.000
at point X=272796.000 Y=962149.000 Z=  0.000        at point X=272348.606 Y=941882.389 Z=  0.000
at point X=272587.000 Y=961697.000 Z=  0.000        at point X=272752.931 Y=940483.238 Z=  0.000
at point X=272503.323 Y=961478.569 Z=  0.000        at point X=273161.195 Y=939037.142 Z=  0.000
at point X=272384.421 Y=961251.933 Z=  0.000        at point X=273282.849 Y=937909.034 Z=  0.000
at point X=271822.421 Y=959158.933 Z=  0.000        at point X=273213.000 Y=936351.000 Z=  0.000
Press ENTER to continue:                            at point X=273051.000 Y=935861.000 Z=  0.000
at point X=271485.426 Y=957921.952 Z=  0.000        at point X=272936.000 Y=935437.000 Z=  0.000
at point X=271196.908 Y=956847.440 Z=  0.000        at point X=272693.000 Y=934671.000 Z=  0.000
at point X=271000.908 Y=955858.440 Z=  0.000        Press ENTER to continue:
at point X=270690.854 Y=954272.168 Z=  0.000        at point X=272706.136 Y=934045.994 Z=  0.000
at point X=270432.854 Y=952951.168 Z=  0.000
at point X=270195.593 Y=951743.877 Z=  0.000
```

Source: Field work 2009

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Opening and replaying the ground control point co-ordinates in Table 6 automatically plotted the route taken by the pipeline. This showed the route taken by the pipeline from Kwali to Abaji in the Federal Capital Territory in Abuja.
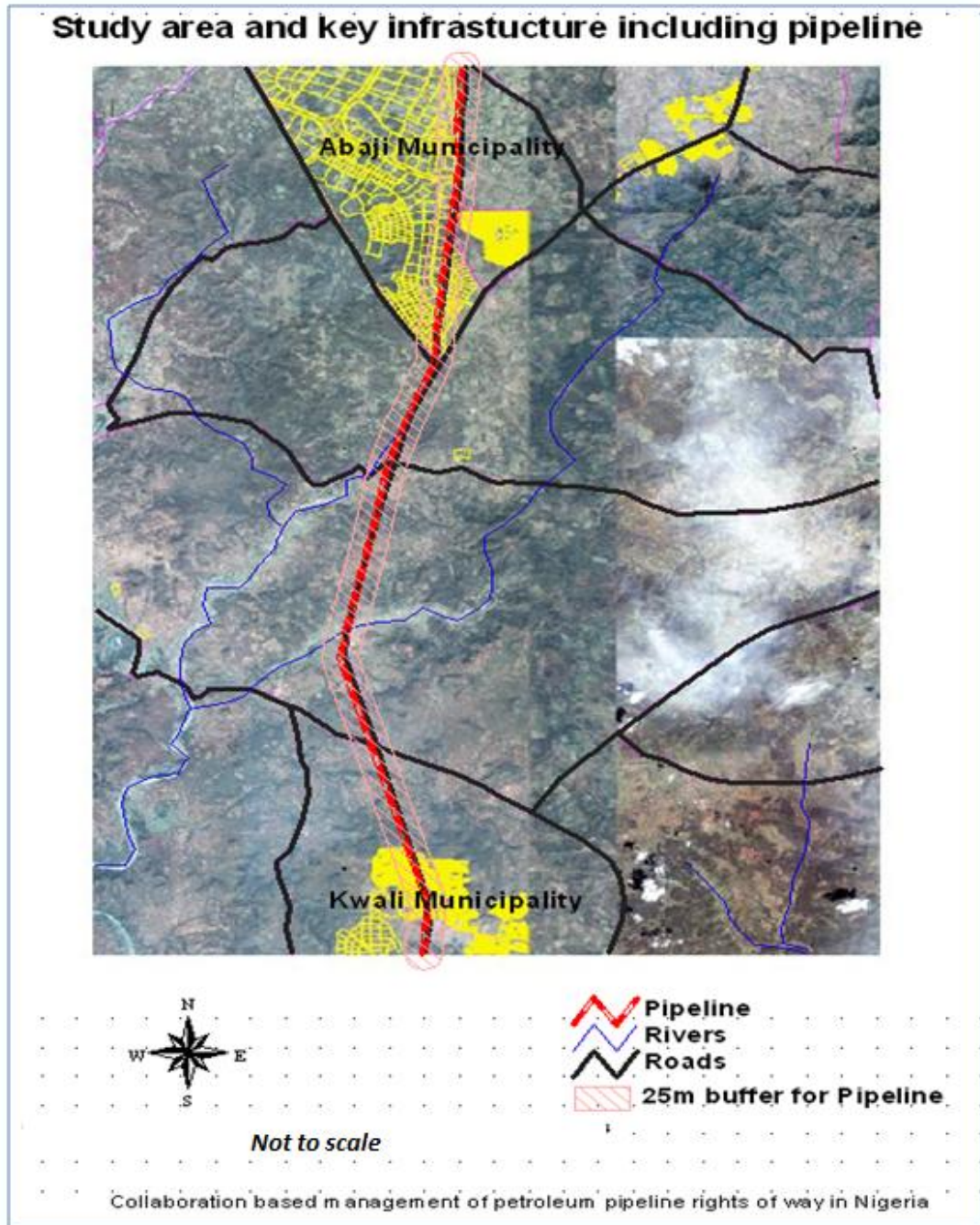
Figure 13: Encroachment of planned settlement on the ROW in Abuja

Source: Field work 2009

The vector data created by digitizing the contour lines was then converted to a raster file and interpolated. As seen in Figure 13, this action resulted in the creation of a

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new cadastral map showing the extent of encroachment of other uses on the pipeline between Kwali and Abaji. Line of sight analyses were then run to establish strategic points on the ROW of the pipelines, coinciding with the ground control points acquired. These points were demarcated to have maximum view from one another for the purpose of monitoring using controlled circuit television camera or helicopter.

A geo-referenced satellite image of the area was then added as a layer. By overlaying the 50m buffer zone on top of the satellite image, the ROW of the pipeline became automatically obvious on the site development plan image, revealing all other uses that encroach on the ROW. Topographic sheets covering the ROW were then acquired, scanned and geo-referenced. An on-screen digitising technique was used to digitise each of the contour lines using a value domain. Data on the socio-environmental and cultural problems associated with pipelines' ROW in Nigeria and the level of host community involvement in their management will be sourced through the administration of questionnaires in communities in the selected sample states across the geopolitical zone of Nigeria where petroleum pipeline vandalism has been reported. This action produced a map of the area from Kwali to Abaji (see Fig. 13).

With the ROW demarcated and made obvious, the ground control points already acquired can be built into an auto-tracking navigator for use in a helicopter. The helicopter could then be deployed for real-time, cross-country monitoring of the ROW against vandalism, encroachment and other illegal activities. This kind of monitoring activity over the ROW would also ensure that pipeline failure due to wear and tear is detected and attended to in a timely manner so that it does not degenerate causing the kinds of large scale environmental problems, such as land contamination and oil spillage, that were found during this study.

Figure 14: Human settlement encroachment in Abuja

Source: Field work 2009

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As seen in Figure 14, the buffer tool was activated to create a 50m buffer along the pipeline route. This action automatically highlighted an area 50m to the left and right of the pipeline. Overlaying a geo-referenced human settlement plan shows a large scale encroachment, cumulatively summing up to about 10% of the sampled ROW. Because the pipeline networks is spread across the country as shown in figure 2, the encroachment on the ROW also affects all geographical zones of the country.

6.4 ROW and the communities

Nigeria is a spatially large country with an economy that is heavily dependent on petroleum. This study has demonstrated (see chapter 6, section 6.4) that out of its national land mass of 923,768 km^2, 3,500 ha is statutorily designated as pipeline ROW (Schatz, 2008; National Assembly Nigeria, 1990d; National Assembly Nigeria, 1967.). What is now called the Nigerian oil and gas industry was born over 50 years ago, in 1956, when oil was first discovered in commercial quantities in Oloibiri, in present-day Bayelsa State in the Niger Delta Region of the country. To enhance the distribution of crude oil products from the oil-rich region of the Niger Delta, both to the export terminals and to other parts of the country for refining and local consumption, a network of oil pipelines has been constructed. The network links over 300 oil fields, 5,284 oil wells, four refineries, ten export terminals and 22 storage depots, forming a mesh whose key nodes include Port Harcourt (I and II), Kaduna and Warri, the off-shore import and export terminals at Bonny and Escravos, and the import jetties at Atlas Cove, Calabar, Okirika and Warri.

Nigeria's total network of 7,000km of oil pipeline consists of 5,315 km of multi-product pipelines and over 666 km of crude oil pipelines. These pipelines criss-cross the entire landscape of the country. Across the case studies for this research, varying cases of encroachment on the 50m ROW were revealed.

6.4.1 Spatial trends of pipeline vandalism in Nigeria

Vandalism of oil and gas pipelines started in the 1980s in the Niger Delta region but has now achieved nearly even national coverage consistent with the spread of the network of petroleum pipelines in Nigeria. Vandalism which primarily results in the loss of products both refined and crude, has also been found to have caused a range

of other problems such as environmental degradation, occasioned by oil spill, and explosions resulting in loss of human life. Vandalism of petroleum pipelines, as this research has found, occurred in the highest frequency in the Niger Delta.

In about six months, 418 oil spill incidents caused by vandalism were reported. Similarly, the act of hostage taking for ransom, of Nigerians and foreigners alike, was serially committed by the vandals in addition to siphoning petroleum products from the publicly owned pipelines. Processed raw data obtained from the two pilot studies and the substantive fieldwork which is indicative of the trend in cases of vandalism in Nigeria from 1997 to 2008 is presented I the table below.

Data compiled from the Nigerian National Petroleum Corporation and its subsidiary companies by the researcher during the preliminary fieldworks in 2008 and the substantive fieldwork in 2009 shows an escalation of the number of vandalism incidents and the associated volume of oil spillage across Nigeria.

Table 7: Pipeline vandalism-induced oil spillage incidents in Nigeria

Year	Number of incidents	Quantity of product spilled in 1,000 barrels
1997	1,339	59,272
1998	1,390	68,937
1999	2,319	81,567
2000	2,637	84,072
2001	2,412	120,976
2008	2,418	150,098
Total	12,515	564,952

Source: Fieldwork 2008-2009 (Compiled from raw data from the NNPC)

As seen in Table 7, in the six years listed, 2,515 incidents of pipeline vandalism were recorded across Nigeria and over 56 million barrels of petroleum products were spilled into the environment across the country. The Table shows that the quantity of products spilled increased astronomically over recent years. From a total annual oil spillage volume of over 59 million barrels in 1997, the volume increased to over 69 million barrels in 1998. The annual volumetric increase in oil spillage owing to pipeline vandalism has continued over the years.

The Nigerian National Petroleum Corporation has lost about US$2 billion in revenue to vandalism years in one decade. The upsurge in vandalism has made it difficult for the corporation to pump petroleum products via pipelines to its 21 storage depots spread across the country. This development has created an artificial scarcity of petroleum products in Nigeria, with consequent economic impacts. This research finds that black market[11] operators have taken advantage of the situation to sell products through non-conventional means, including product adulteration, which caused both domestic and industrial explosions on various scales in the country, causing loss of life in the communities. The black marketers do not contribute positively to the formal economy, for example, by paying business taxes.

6.4.2 Pipeline vandalism: Implications for the Nigerian economy

As a vital element in the transportation of oil and gas products in Nigeria, the pipeline will continue to be a major source of contradictions. Findings show that behind the veneer of this lucrative enterprise lies an uncomfortable mix of extremes of wealth and poverty, power and disempowerment, profit and exploitation, global extraction and local resistance. Furthermore, Nigeria experienced a capital flight of well over $86.5 billion between 1970 and 1996, and the financial assets held by a very small fraction of its populace in private bank accounts, real estate and shares overseas quadrupled the public external debt of the country in 1996. State revenues from the export of oil and its derivatives have been estimated to account for $350 billion between 1965 and 2000.

According to the International Monetary Fund, in 2005 alone, oil revenues accounted for 99% of export revenue, 88% of total government income, and 50% of Nigerian gross domestic product (GDP), amounting to over $50 billion (Okonjo-Iweala and Osafo-Kwaako). This study shows that the people are desirous of being part of plans aimed at managing the pipeline network to stop the vandal barons and their recruits from undermining its oil and gas production and transportation activities.

Nigeria has a long term plan to increase its daily production from the current level of 1.6 million barrels per day to as much as 5 million barrels per day in 2020 (Greene et

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[11] Black market operators are traders who sell regulated products at prices higher than what is prescribed, in a manner not consistent with the open market economy.

al., 2006; Servant and Forster, 2003). With a conservative price benchmark of $50 per barrel, Nigeria could amass more than $750 billion in oil income within the same period but this will be under threat if the pipelines are not managed within a framework that engenders the support of all the stakeholders.

6.5 The cost of compensation

Findings from the terrain analyses above show that of the 23km of pipeline traced in the Federal Capital Territory, Abuja, 10% had been encroached upon by human settlement This equates to 2.3km of the 23km stretch of the ROW in Abuja. The standard compensation rate for demolishing household dwelling units for overriding public interest is 2 million Nigerian Naira (US$10,000) (Muhammad Bashar et al., 2010; Ocheje, 2007; Owei, 2007). Terrain analyses also show that averages of 15 dwelling units were found for every 1km of the encroached upon ROW in Abuja. These indices were extrapolated for the 7,000km and produced two key results:

  i.   The approximate length of the ROW encroached upon and
  ii. The approximate of cost of compensation.

The calculation is thus:

The total length of pipeline = 7,000km

Encroachment= 10%

Percentage of encroachment= 10% of 7,000= 700km

Cost of compensation per dwelling unit = US$10,000

Number of encroaching units per kilometre = 15

Cost of compensation/kilometre = US$1,050, 000

Therefore, compensation across 10% of pipeline = US$1,050, 000x700 = US$ 105,000,000.

Thus, the cost of compensating property owners for the demolition houses on the ROW can be estimated at about US$105 million.

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6.6 Chapter summary

In this chapter, the discussion focused on demarcating the ROW of petroleum pipeline using geographic information systems in Nigeria. Using terrain analyses, the study extrapolated the extent of encroachment, the geographical spread and its implications for the national economy before computing the financial implications of a programme of compensation to remove the affected human settlements.

Demarcating the ROW of the pipelines generated a discrete set of ground control points which produced a set of data that could be used for other analyses. By repeating the process, the GIS-based programme can be used to demarcate the entire 7,000km length of pipeline in Nigeria. The ground control point data set acquired was used to digitally plot the route taken by the pipeline in the Federal Capital Territory of Nigeria. Activating the buffer tool in ArchGIS, a 50m buffer was created across a distance of 23km, depicting the ROW of petroleum pipeline over the 23km length of pipeline walked in Abuja. This data set is useful for the auto-tracking of pipeline from a helicopter. Spatial analyses using digitising techniques produced the actual extent of encroachment on the 23km stretch of pipeline traversed on foot during the fieldwork. This chapter has thus set the stage for a more detailed analysis of the social, economic and environmental issues raised from the data collected from the field.

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CHAPTER 7

CASE STUDIES

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CHAPTER 7

CASE STUDIES

7.1 Introduction

In chapter five, the researcher discussed the necessity of designing and conducting the pilot phase according to the study's theoretical bases. The pilot studies informed a further refinement of the research methodology and methods for the substantive fieldwork. The analysis of the data from the pilot studies led to the identification of reliable sources of data from key informants and focus groups, testing the reliability of the selected data collection techniques, and assessment of the appropriateness of the selected data analysis techniques. As a result, further insight into the study's context and scope were gained.

In chapter six, results of the method for demarcating the ROW in Abuja were analysed and presented, an outcome of which has been the development of a comprehensive, GIS based framework for demarcating and monitoring the network of pipelines in Nigeria. Following through from the previous chapters, this chapter now presents the findings from the four case studies: Abuja, Otukpo, Enugu and Port Harcourt. The case studies have been deliberately chosen to span the geographical groups of the nation, drawing upon on the evidence about pipeline vandalism across the country gained from the pilot studies and the contextual literature presented in chapter three. The analysis of each case study is organised around three main themes. These are: the issues of impedance to interactions amongst communities separated by the ROW; and the host community-based social and environmental problems associated with the pipeline and the ROW in Nigeria.

7.2 Case study selection

As mentioned in chapter four, the four case studies were selected based on the geopolitical[12] groupings of Nigeria. Two case studies each were selected from the north and southern regions of the country respectively. Selection of the case studies was informed by the two pilot studies undertaken prior to the substantive fieldwork.

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[12] A geopolitical zone in Nigeria is derived from the division of the 36 states into six zones with geographical and political affinities.

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As mentioned in chapter five, Abuja, in northern Nigeria, was selected as one of the case studies. This selection was informed by its status as the new purpose-built administrative and political capital of Nigeria, with all zones of the country represented in its population. Otukpo, in the Idoma[13] Senatorial District of Benue State in the north central zone, was selected as the second case study from the northern region, based on findings from the pilot phase, which revealed cases of vandalism and environmental pollution in the area. Enugu, in the south eastern zone, was selected based on its role as a major pipeline distribution hub with high cases of recorded vandalism (Ejiofor and Ezigbo, 2010). Port Harcourt was selected because of its status as the traditional headquarters of the oil producing Niger Delta Region of Nigeria. In addition to the four case studies mentioned above, detailed geographical contexts for the selected sample survey locations have been presented in chapter three.

Analysis in this chapter is hinged on two assumptions. The first is the settled classification of the self-employed in Nigeria mostly as also the under-employed (Department for International Development, 2008; World Bank, 2004). Secondly, singular tabular percentages (%) are reported in textual format instead of tables that present only one important value. This strategy eliminated from the chapter, tables from which only one percentage can be deduced. The chapter presents a consecutive analysis of each case study and concludes with a chapter summary.

7.3 Return of completed questionnaires

In all, 600 structured interview questionnaires were administered in communities spread along petroleum pipeline ROW. The respondents were aged from 18 to over 60 in all four studies. The key informant technique was also adopted because the pilot survey revealed that it would generate valuable data supplementary to the focus group discussions in the case studies. At the end of the field survey, 588 questionnaires representing 98% of the total of 600 were completed and this formed the basis of the analysis, results of which are presented below.

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[13] Idoma is a major ethno-linguistic group in the North Central geopolitical zone of Nigeria.

Table 8: Completed questionnaires

Case Studies	Frequency	Percentage
Abuja	139	23.6
Otukpo	146	24.8
Enugu	135	23.0
Port Harcourt	168	28.6
Total	588	100.0

Source: Fieldwork 2009

Further to the information presented in Table 8, it is relevant to note the percentage of administered questionnaires that were completed in each case study. In Otukpo, north central zone, 146 respondents, representing 24.8% of the sample size, completed all the questionnaires administered in this case study. Similarly, a 100% rate of return of completed questionnaires was recorded in Port Harcourt and Enugu, both in the southern zone of Nigeria. However, in Abuja, the rate of return of completed questionnaires stood at 98.4% at the end of the exercise. Twelve of respondents, representing 8.6% of the 139 respondents in this case study, failed to return their questionnaires. Even so, however, the 98% rate of return of completed questionnaires was very high (Bryman, 2008).

In Abuja where the main field work started, around half of the questionnaires were left with the respondents for a day to enable them to complete them before collection while the second half were completed in the presence of the principal researcher or his research assistants. As a result, 12 respondents who had questionnaires given to them to complete over a period of one day did not return them. As explained in Chapter 5, Section 5.9.4.2, based on this experience, questionnaires were completed on respondents in the other three case studies in the presence of the principal researcher or his research assistants and collected immediately afterwards. This change in questionnaire administration strategy accounted for the 100% rate of return of completed questionnaires recorded in Otukpo, Enugu and Port Harcourt.

The survey took cognisance of the distribution of pipeline network through the different geopolitical groupings of the country, with each geopolitical zone having a fair distribution of the pipeline network and an average of three dispensing depots.

Detailed analyses of field survey results from sample locations in each geopolitical zone of the country are presented below.

Analysis of each case study is organised around the following four themes: awareness and perception of pipelines that traversed communities; understanding of applicable laws protecting pipelines and associated ROW; pipeline vandalism and community safety; and synergy building for collaboration enabled framework for management. The presentation begins by setting out analyses of each case study consecutively and ends with a cross-case synthesis.

7.4 Network of petroleum pipelines in northern Nigeria

The field survey was undertaken in two pipeline communities[14] in the northern region of Nigeria, namely Abuja and Otukpo. Abuja was selected based on its central geographical location and its status as the administrative centre of national government activities in Nigeria and widespread cases of vandalism-induced pipeline failures. Preliminary findings during the pilot study revealed that incidences of vandalism were rife in Otukpo, with records of human and environmental costs.

7.5 Abuja and pipeline infrastructure in Nigeria

Abuja is located almost at the geographical centre of Nigeria (Thomas-Emeagwali, 1989). The Federal Capital Territory (FCT) lies within latitude 8^0 23' and $9^0$15'N and longitudes $6^0$45' and $7^0$35'E. It is bounded to the west by Niger and Kogi States, on the east by Nassarawa State and on the south by Niger, Kogi and Nassarawa States. It has six Area Councils[15]. Abuja was built to function as an all purpose capital for central government administration and as Nigeria's new political capital. The selection of Abuja as the new capital of Nigeria was conceived after extensive feasibility and site selection studies (Ikoku, 2003).

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[14] A pipeline community is a community traversed by pipeline.
[15] An Area Council is the Abuja equivalent of a Local Government Area.

Figure 15: Map of Abuja showing phases of Physical development

Source: Independent National Electoral Commission 2008

As illustrated in figure 15, the pipeline in Abuja has its origin in Kogi[16] state on the southern fringes of the territory. The pipeline traverses Abuja from Abaji Area Council through Kwali and Gwagwalada Area Councils to Suleja in Niger state, also situated in the north central zone of the country.

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[16] Kogi state is a sub-national administrative and political unit in the north central geopolitical zone of Nigeria.

7.5.1 Abuja: pipeline and the people

Although the decision to build the new Nigerian capital in Abuja was taken in 1976, it was only in 1991 that the movement of the seat of government which heralded the relocation of the official venue of central government business from Lagos took place. This resulted in the influx of Nigerians from all parts of the country in search of the economic opportunities created by the movement of government business to Abuja (Ekwe and Ike, 2006). The decision was meant to help answer the land use and infrastructural management challenges that had characterised the co-location of the Lagos state government as well as the federal government in the same restrictive geographical location on the western Atlantic shores of the country (Ikoku, 2003). Abuja, the new national capital, plays the dual role of being the administrative headquarters of the country and the seat of central government.

Physical planning and development started in the city region, which was then over 200km away from the route of petroleum pipeline, which had existed on its southern agrarian fringes before Abuja was created in the mid 1970s (Meek, 1953). However, this development ultimately resulted in the expansion of rural and urban communities onto the ROW of pipelines in Abuja. The vandalism of pipelines also increased with the designation of Abuja as the Federal Capital Territory of Nigeria (Okoro and Abuja, 2004).

7.5.2 Indigeneity and land rights in Abuja

The Federal Capital Territory Act abolished the traditional title to land that had existed for natives of Abuja (National Assembly Nigeria, 1990a). The Act vested control of the 8,000km^2 land within the capital territory in the Nigerian President, who delegates the administration of the territory to the Cabinet Minister (Ikejiofor, 1997). The natives[17] of Abuja, as well as being stripped of their traditional title to land by this Act, were excluded by the Nigerian Constitution of 1999 from aspiring to the office of the minister of the territory, which is the highest political office in Abuja (National Assembly Nigeria, 1999).

The Land Use Act of 1976 had further complicated the issue of rights to land in Nigeria. Land in all parts of the country was invested in the state Governor, whom

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[17] Native is used connote pre-historic settlement ethno-linguistic tribe in Nigeria.

the law empowers to hold the land in trust for the people of his state (National Assembly Nigeria, 1990b; National Assembly Nigeria, 1990a). Through the traditional tenure system, there was a hereditary succession to land titles, but this was brought to an end by fiat of state through the promulgation of the Land Use Decree of 1976 (Nuhu, 2006). The natives of Abuja were now to live on their otherwise native land as a landless people who, like every other Nigerian, could only gain a title to use any piece of land within Abuja through the express grant of the president or his representatives (National Assembly Nigeria, 1990a).

Table 9: Origin of the sample

Are you a native of Abuja? (N=123)	Percentage
Yes	55.3
No	44.7
Total	100.0

Source: Fieldwork, Abuja (March) 2009

As seen in Table 9, over 55% of the respondents in Abuja had settled in the area before it was proclaimed by law as the Federal Capital Territory of Nigeria[18] in 1976(National Assembly Nigeria, 1990a) ; in fact, they were all native to the communities around the ROW of petroleum pipeline. Native community lands were compulsorily acquired for the pipeline project over three decades ago. The compulsory acquisition that took place was against the wishes of the natives, albeit with the promise of compensation. The promised compensation has eluded generations of natives in these Abuja communities with each successive generation waiting patiently but to no avail (Akpan, 2006).

Almost half of the population of Abuja are economic migrants, mostly from other parts of the country and the West African Sub Region, migrating to Abuja in search of the economic opportunities that have resulted from the creation of the new Nigerian Federal Capital.

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[18] Abuja native communities existed before the movement of the Federal Capital of Nigeria from Lagos to the present day Abuja.

Table 10 Length of stay of respondents in Abuja

Length of stay in Abuja (n=123)	Percent
Less than five years	14.6
More than five years	85.4
Total	100.0

Table 11 Occupational division of respondents in Abuja

Occupation(n=123)	Percent
Self employed	61.0
Public sector	17.9
Private sector	21.1
Total	100.0

Source: Fieldwork, (March) 2009

As shown in Tables 10 and 11, about 85% of the respondents in Abuja, both natives and non natives alike, have lived in their respective communities which encroach on the ROW of the petroleum pipelines, for over five years. Over 61% of the respondents were self employed in the informal sector, while only 17% were employed in the public sector. The informal sector, which accounts for most self-employment in Nigeria, is still basically agrarian and artisan-based, with practitioners living perpetually below the poverty line on a meagre per capita income of $843 (IMF, 2006). This income has further reduced owing to the 2008/2009 global economic downturn.

Figure 16: Locals scooping oil from a damaged tank

Source: Department for International Development (2008)

The pervasive poverty amongst the locals in the pipeline communities[19] has further rendered them vulnerable to the temptation of gaining sustenance through criminal activities such as those perpetrated on vandalised pipelines and other facilities for transport and storage of products (World Bank, 2004). As seen in Figure 17, the local people in Abuja have been propelled by extreme poverty and hunger to scavenge petroleum products from a vandalised petroleum infrastructure. Many of the people interviewed agreed that they occasionally scavenge for petroleum products from damaged pipeline, with some claiming to earn a living from it. Several members of the community have been arrested while scavenging for petroleum products and prosecuted by the government. They also claimed that fire outbreaks are a common risk and that this has caused explosions and large scale fires that have claimed many lives (Onuoha, 2008b). Incessant loss of life in large numbers has not deterred locals in pipeline communities in Abuja from engaging in high risk activities along the ROW (Idoko, 2009), a situation that goes to emphasise the dire poverty that confronts these communities.

Figure 17: Farmland contaminated by vandalism in Abuja

Source: Fieldwork, (March) 2009.

As illustrated in Figure 18, oil spills caused by vandalism have contaminated large expanses of arable land in Abuja. The contaminated land is no longer fertile for

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[19] Pipeline communities are the settlements around the ROW.

agricultural production; a bioremediation process, which can last for years, is required to restore the agricultural viability of the affected land. The technology for bioremediation is not available locally and is expensive to apply to affected sites, which are mostly located in rural Abuja. A plethora of other arable agricultural sites contaminated by vandalism-induced oil spills is on the increase in Abuja. Over 50 sites were encountered during the fieldwork conducted from March to May 2009.

In this way, arable lands for subsistence and commercial agriculture are increasingly being reduced, with implications for the economic wellbeing of the agrarian people who dwell along the ROW in Abuja. The loss of arable land also translates into unemployment for the self-employed in the informal sector of the mostly agrarian Abuja economy. As one offender interviewed in custody said:

> *I engaged in vandalism as a last resort for survival in the face of unemployment and poverty, not minding the potential cost, which could be serious injury or death from possible fire outbreaks or imprisonment. (*John, ROW community in Abuja, 22nd April 2009).

A similar situation was reported in Sangoloye (2009) where a pipeline vandal claimed he had been successfully engaging in vandalism for several years before luck ran out on him on the fateful day he was arrested, and he was willing to go into vandalism upon release from custody if there were no other means of livelihood for him.

Despite this imminent danger to life and limb, and the risk of arrest, prosecution and ultimate imprisonment, the offender was still prepared to return to this way of life if no other means of survival presented itself. The pool of idle hands that could easily turn to vandalism is in ready supply due to the continued loss of arable lands. With more youthful hands missing out on gainful employment and engaging in vandalism as an alternative, more cases of vandalism will be recorded, further eroding the extent of arable lands due to the effects of oil spills. This scenario has been reported to have the potential of creating a vicious circle of vandalism and unemployment, with each playing the role of a catalyst for the other and the pipelines, their ROW and the deforestation-prone ecosystem being further destroyed (Howorth and Mitchell, 2004).

7.5.3 Literacy levels in Abuja

Most of the inhabitants of the ROW communities were self employed in the informal sector of the economy. The majority in this group were engaged in the subsector of subsistence agrarian work.

Table 12 Literacy levels in Abuja

Level of education	Percentage	Cumulative percentage
Non formal	0.8	0.8
Primary	30.1	30.9
Secondary	66.7	97.6
Tertiary	2.4	100.0
Total (n=139)	100.0	

Source: Fieldwork, (March) 2009.

As shown in Table 12 above, the majority of the inhabitants of the pipeline communities in Abuja were workmen and women with only school-level education. About 67% of the respondents in Abuja were secondary school[20] leavers without vocational training for technician-level employment in the formal sector. Lack of vocation-based employability skills in the great majority of the pipeline community dwellers tilts them to agrarian livelihoods that rely heavily on the very ecosystem which pipeline vandalism and the resultant oil spill in the area has constantly operated to contaminate, the implication of which is a net loss of arable land to support people's subsistence activities, thereby creating a situation of crisis survival.

7.5.4 Heterogeneity in Abuja communities

The pattern of migration in Abuja shows the influx of people from other parts of the country in search of the economic and social opportunities created with the movement of the seat of the central government from Lagos to Abuja. Before the creation of the new federal capital territory of Nigeria in 1976, Abuja was sparsely populated, with a small number of indigenous native settlers who at the time practised subsistence agriculture. However, with the movement of the seat of government and all associated public service machinery from Lagos to Abuja on December 12, 1991, the pattern of population growth changed (Moore, 2008). In 2006, just two decades after the movement of the seat of government (Government of Nigeria, 2006), the population of Abuja had risen to 1,405,201 persons.

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[20] In Nigeria, secondary school is the segment of studies immediately after primary school and typically takes 6 years to complete

Table 13: Pipeline impoverish ROW communities

Pipeline impoverish ROW communities	Percent
Agree	71.3
Disagree	28.7
Total (n=139)	100.0

Source: Fieldwork, (March) 2009

As illustrated in Table 13, over 71% of the respondents in Abuja agreed to the proposition that the pipeline impoverish the communities in spite of the new trend of immigrant population movement since it assumed the status of Nigeria's national capital. This shows new opportunities that the designation of Abuja Nigeria's national headquarters has not changed the opinion of the people about the negative consequences of the pipeline project of the economic situation. People from all sub-national units in the country and the West African sub region migrate to Abuja in search of the growing public service and business opportunities associated with the ever increasing number of state and regional agencies that have established a presence there but this has not neutralised the demand of the people on the authorities because of the pipeline project. These migrants rely on the provision of the Federal Capital Territory Act of 1976 (Nuhu, 2009) to claim their place alongside the indigenous population. As stated earlier, the mainly youthful population in the Abuja pipeline communities engages mostly in informal employment as a last resort, in the absence of the white collar employment which attracted them to Abuja. This army of youthful hands with unmet life expectations remain exposed and vulnerable to the temptation of the illicit act of petroleum pipeline vandalism.
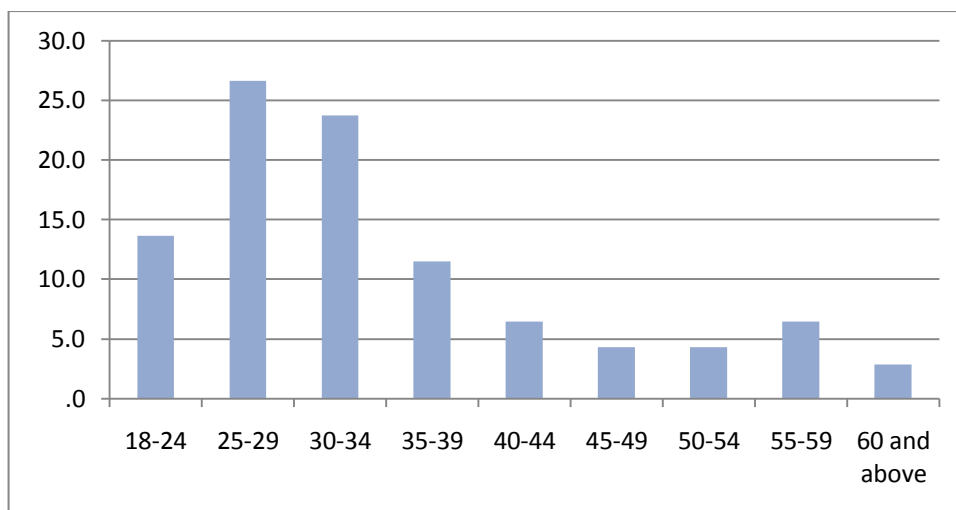
Figure 18: Age Distribution of Respondents in Abuja Pipeline Communities

Source: Fieldwork, (March) 2009.

As indicated in Figure 18, over 80% of the respondents interviewed in the communities along the pipeline were within the youthful range of 18-44 years of age. The very active age group of 30-34 years constituted over 30% of the sample of the subsistence agrarian communities along the ROW in Abuja. Although the sampling method used cannot be presumed to have elicited an accurate age distribution for the community population, it is nevertheless indicative of the youthful age profile of this settlement. In the face of deteriorating living standards (World Bank, 2004), these young people are prone to desperation in order to improve their living standards.

The level of awareness about the existence of pipelines in the pipeline communities in Abuja is very high. Over 80% of respondents were aware of the existence of pipelines in their community lands. There was a similarly high level of awareness about applicable laws for the protection of the pipelines and their associated ROW. In spite of this very high level of awareness on the part of the inhabitants of these communities, the incidence of vandalism is also high, with community members not accepting responsibility for these harmful activities that destroy their ecosystem and threaten the fertility of farmlands in their communities.

Figure 19: Building on the ROW in Abuja

Source: Fieldwork, (March) 2009

As seen in Figure 20, it is not only dwellings that have encroached on the ROW in Abuja, but cash crops such as palm trees were also seen to encroach. Concrete structures were also observed on the ROW. Some of these structures were apparently on top of the pipeline, which is buried only about a metre underneath. This portends great danger to the households in the affected buildings in the event of damage to the pipelines, either natural or man-made.
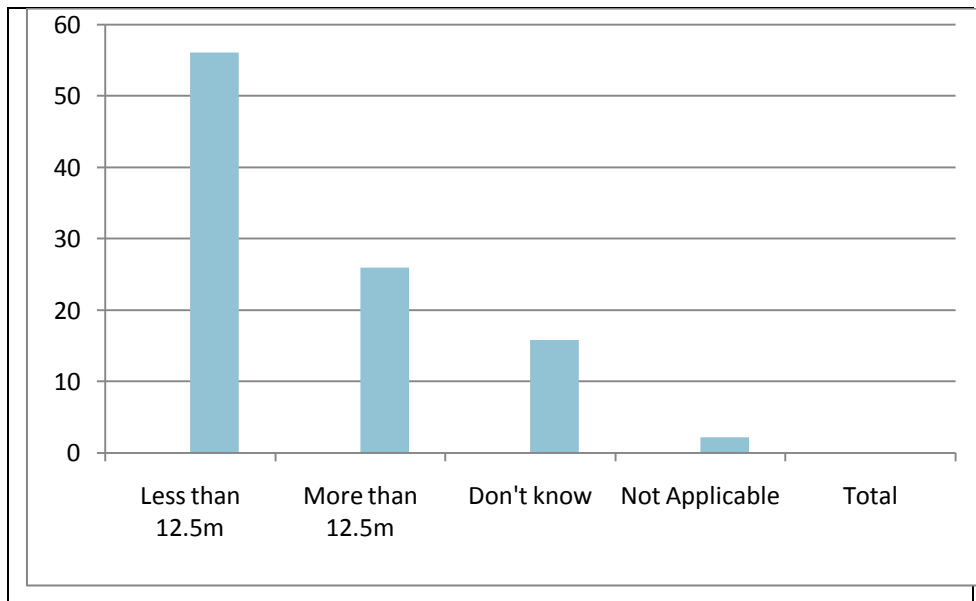
Figure 20: Degree of encroachment on ROW in Abuja

The ROW, though statutorily protected (Brume, 2007; National Assembly Nigeria, 1990d), have been encroached upon by many communities in Abuja. Many communities have extended into the 12.5 metres on both sides of the pipelines, in contravention of the law. These communities are also in danger of vandalism-induced fire, which many ROW have suffered in Nigeria in the past decade (Orji et al., 2008). Figure 20 above illustrates, owners of the buildings that have encroached in Abuja were not only aware that the buildings were within the statutory buffer, but many of them as shown earlier in figure 17, occasionally participated in scavenging petroleum products from damaged pipes. As also determined from the questionnaire, over 62% of the respondents in Abuja communities live within the 25 metres of the buffer in disregard of the statutory stipulations against their.

7.5.5 ROW crossing as daily routine in Abuja

The agrarian nature of the communities along the ROW predisposes the community members to agrarian subsistence practices involving spontaneous movements in search of sustenance from their surroundings. The movements make for engagements between the community members and their farms and other subsistence activities, some of which are located across the pipelines. Interactions between communities on different sides of the pipelines have helped to promote crossing the ROW, especially in communities with cultural affinities that predate the advent of the pipeline project, and in spite of the apparent legal restrictions imposed by the ROW on their otherwise unfettered intercommunity activities.

The apparent restrictions on intercommunity interactions are more pronounced in areas where the designated crossing points, which coincide with officially designated vehicular crossing points, are several kilometres apart. In cases like this, the community members are presented with the option of travelling long distances to the designated crossing points or taking the risk of an illegal act and possible liability for its consequences by making a short cut across the pipelines.
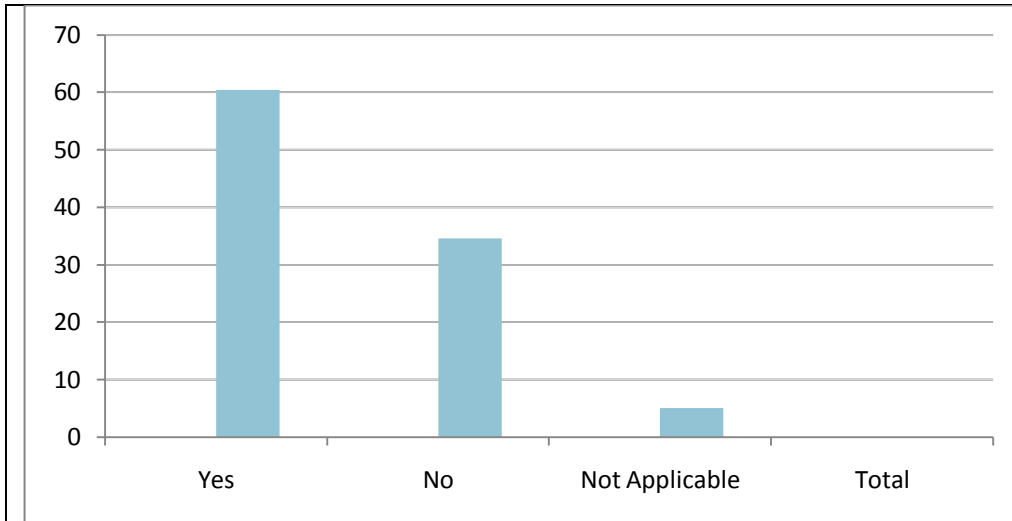
Figure 21: Daily pipeline crossing in Abuja Communities

Source: Fieldwork, 2009.

As illustrated in Figure 22, crossing the pipeline is the normal routine for over 60% of the respondents in communities around the pipelines in Abuja. A majority of the people engage means of livelihoods that derive mainly from agrarian socio-economic activities (World Bank, 2004). This study finds that ROW crossing in search of daily subsistence is widely practised in Abuja because applicable laws are not enforced. It is gradually becoming the rule because it now enjoys the apparent endorsement of many communities. Community members resort to it for movements across the pipelines to their farms, to markets or to sister communities, in preference to taking the longer route by the designated crossing points.

7.5.6 Land acquisition and compensation in Abuja

Land acquisition for petroleum pipeline projects in Abuja was effected under the Nigerian National Petroleum Corporation Act of 1977. At the inception of the pipeline project in 1977, the Nigerian National Petroleum Corporation was empowered by law to take land and pay compensation for both the land and commercially-cultivated trees destroyed in the course of the pipeline project. The duty to pay compensation to owners of land and trees cultivated for commercial use was, however, abrogated with the coming into effect of the Nigerian Land Use Act in 1978, barely a year into the implementation of the Nigerian National Petroleum Corporation policy of compensation payment. This allowed payment only for commercially-cultivated trees. The situation was further complicated by the

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Petroleum Act, which usurped all rights, privileges and benefits accruing from petroleum resources to the central government (National Assembly Nigeria, 1969).
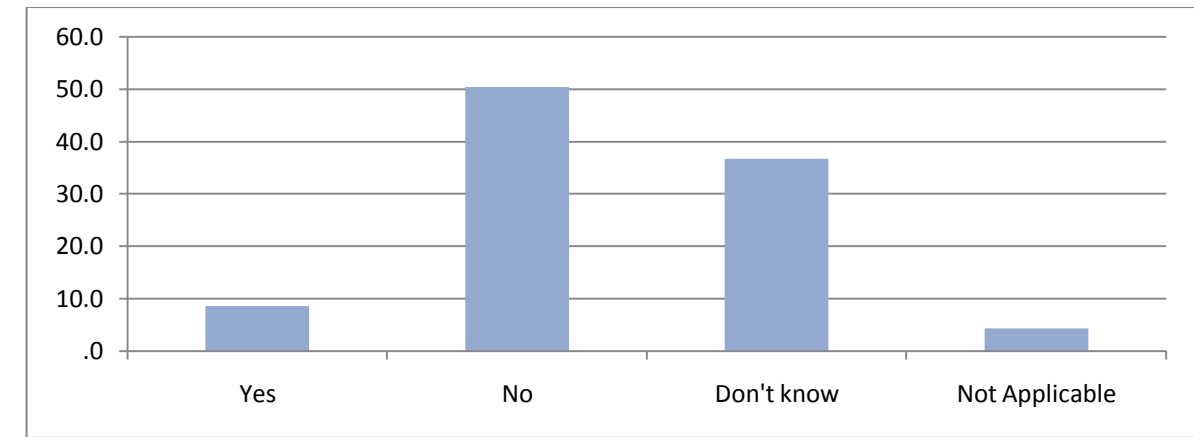
Figure 22: Compensation for Lands Acquired for Pipeline Project in Abuja

Source: Fieldwork, 2009.

As illustrated in Figure 23, less than 10% of the respondents in Abuja received compensation at the inception of the pipeline project before the Land Use Act came into force. The Nigerian National Petroleum Corporation was also given exclusive discretion to determine the amount of compensation payable. Over 50% of the respondents had not received any compensation for the land they lost to the pipelines project over the 30 years since the project was completed in Abuja. About 38% of the respondents were not aware if their families had been compensated for the lands acquired over three decades ago. This group did not qualify for receipt of compensation at the time because they were younger than 18, the legal age of entitlement. Having turned 18 since then, they would qualify as eligible for compensation, in addition to the original group that had not yet received compensation for land acquired. The people in the communities whose land was taken were still hopeful that the government might decide to give them what they regard as their rightful compensation for the land taken from them.

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7.5.7 Community attitude towards pipelines in Abuja

Communities in Abuja see the pipeline project as a sort of government presence in their domain. Many of the community members were excited, despite the remoteness of their communities from the hub of government activities, that they still played host to a key government infrastructure. The hope that the government might decide to pay had a positive effect on the attitude of the people in these communities towards the pipelines. Beyond the pipeline and the occasional losses they suffered, the people believed that compensation for their community land would be paid one day, so they continued to demand it from the authorities.
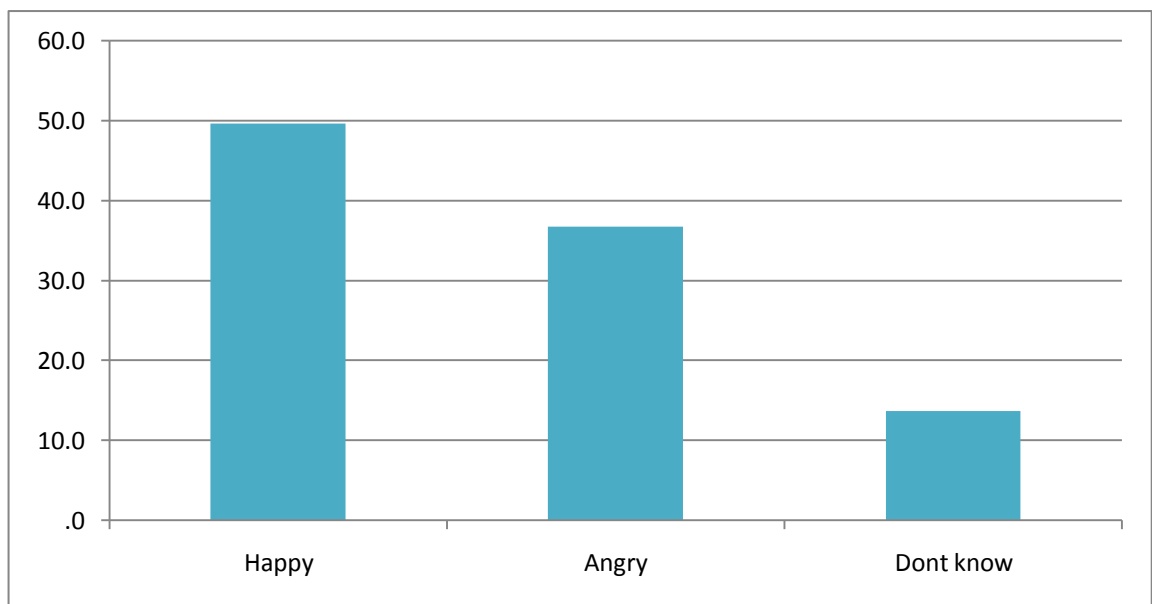
Figure 23: Community attitude towards the pipeline in Abuja

Source: Fieldwork, (March) 2009.

As seen in Figure 24, the findings from this research show that about half of the Abuja pipeline community members were happy that there were pipelines in their community. On the contrary, about 45% of the respondents expressed anger towards the pipelines. They hinged their ill-feelings on the non-availability in their community of the products which the pipeline transports. They said further that the petroleum products which the pipelines transport were not available at official rates in their community.

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Figure 24: Pipeline route used as a footpath in Abuja

Source: Fieldwork, (March) 2009

This research found that some stretches of the illegal crossing points were less than a metre above the pipeline. The locals were mostly unaware that the footpath they have used for many years, as seen in Figure 24, contravenes the statutory provisions of the Pipeline Act (National Assembly Nigeria, 1969).

7.5.8 Pipeline vandalism and Abuja communities

Vandalism is a sporadic, disaster-bearing occurrence in Abuja ROW communities. Explosions owing to vandalism and other forms of pipeline failure are witnessed frequently by the people in these communities.
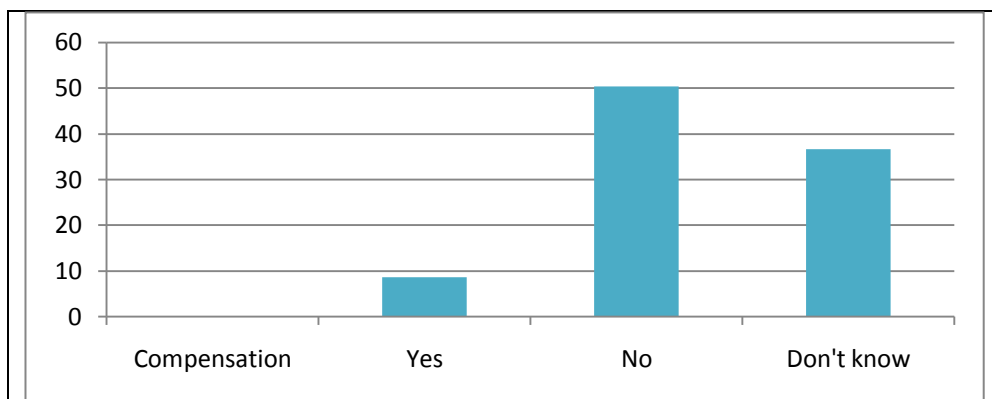
Figure 25: Experience of vandalism in Abuja pipeline communities

Source: Fieldwork, (March) 2009

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As illustrated in Figure 25, about 50% of the people had not experienced vandalism in Abuja. About 9% of the cases of vandalism experienced were reported to have been in connivance with community members. About 11% of the respondents reported loss of loved ones and properties owing to pipeline vandalism. A majority of the respondents in these communities still maintained that they had not resorted to breaking the law in protesting the sustained losses they had suffered. Over 50% of the respondents did not agree that the pipelines had separated their communities. They maintained that the artificial barriers imposed by the pipelines had not affected their movements to other communities across the pipelines.

Against the provisions of the pipeline law (National Assembly Nigeria, 1990d), this research finds that people cross the pipelines at undesignated points whenever necessary. They believe that if they observed crossing restrictions, this would impinge on their intercommunity commercial activities. They also argued that such restrictions could impoverish the communities and weaken their resilience for dealing with the explosions that periodically plague them. Oil spill and soil contamination were advanced as key indices of vandalism which impoverish the communities along the ROW in Abuja. One key informant, a community leader in Abuja, stated that:

> *[...] vandalism, and the resultant oil spillage, has contaminated our rivers, which are one of the major sources of drinking water in our communities. As a result, we resorted to hand-dug wells for potable water but, lately, we have also started noticing contamination in the hand dug wells. This has been confirmed as the result of oil seepage from vandalism-induced oil spillages. This has certainly also affected large expanses of our sacred community land, as the people are unhappy that their pleas to the government and the national oil company for help have not attracted any relief package. (Community leader Abuja, 0 2/04/2009).*

The loss of sacred community land to the pipeline projects was not widely reported in Abuja. However, the communities had experienced so many explosions that they were then living in the fear that yet another pipeline-induced explosion might be about to happen at any time. Over 80% of the respondents agreed that the pipeline ranked highest on the list of risks to their community. The communities had, over the

past decade, suffered public health problems such as water pollution and bush burning, but maintained that the scenic community amenities in Abuja had not been destroyed (Galliano and Loeffler, 2000).

7.5.9 ROW and criminality

A community-wide upsurge in criminal activities was not reported in most of the communities. However, 74% of the respondents said that criminal activities revolved around the pipeline and were occasionally witnessed when pipeline vandalism syndicates invaded the community. They maintained that the ROW had been left to lie perennially fallow, a development which the vandals had exploited over time to damage the pipeline in order to siphon off petroleum products (Jochelson, 2004).

Figure 26: Illegal crossing and results of vandalism on the ROW in Abuja

Source: Fieldwork, (March) 2009

As illustrated in Figure 26, the ROW community members in Abuja cross the pipelines in search of daily subsistence in the course pursuing of their livelihoods. They have exploited the absence of a functional management framework for protecting the ROW (National Assembly Nigeria, 1990d). The restrictions imposed by the law are impugned by the people because they are not enforced.

Violent raids by state agents were reportedly common in the communities, especially after major acts of vandalism were recorded. After each incidence of vandalism, secret service agent would invade the communities in search of identifying accessories to the acts which in Nigeria is a capital offence (National Assembly

Nigeria, 1990e) mostly after the primary perpetrators had left the communities and so failed to achieve any successful prosecution in courts of law. Investigations after raids have shown that post-vandalism raids mostly resulted in the arrest of innocent bystanders or scavengers who only went to the scene of the vandalism long after the vandals had left. Asked to comment on the problem of pipeline vandalism, a member of management staff and union leader of the Nigerian National Petroleum Corporation said:

> *[...] the problem of pipeline vandalism in Nigeria is due to the activities of Vandal Barons who profit from the oil they siphon off from the pipe. Some of them connect pipes from their petrol service station to the multi-products pipeline, siphoning products undetected for years because the ROW are not monitored. Vandalism has caused the corporation and, by extension the country, so much in product loss and the repair costs, not to mention the environmental damage it causes, and then there are the implications for the health and safety of the people affected in the communities (Labour leader, Nigerian National Petroleum Corporation Headquarters, 06/04/2009).*

7.5.10 Abuja communities and involvement in ROW management

Community members in Abuja presently do not have any role in the management of the pipeline that traverses their communities. This is because issues having to do with the pipeline in Abuja are within the exclusive jurisdiction of the federal government, to the exclusion of the community members and other tiers of government in the country (states and local government).
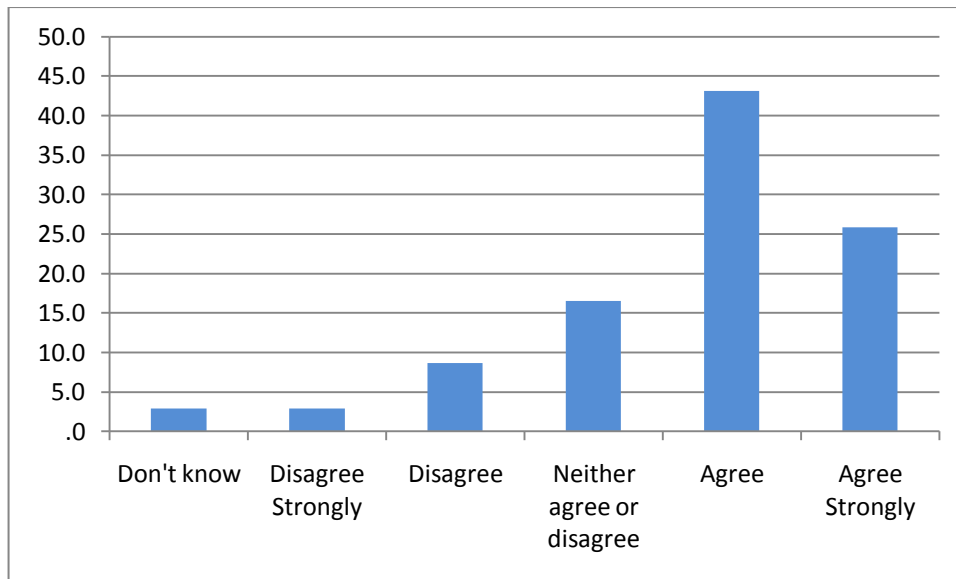
Figure 27: Abuja community members to be involved in ROW management

Source: Fieldwork 2009

As seen in Figure 27, 60% of people want their community members to be involved in the management of the ROW, because according to them the ROW in Abuja provides a platform that engenders general unity and inter-community collaboration among pipeline communities. They have used this common front for making demands for compensation from the government for the land acquired from them three decades ago. Over 20% of the respondents said that the pipelines have been a rallying point for the communities' agitation against perceived neglect by the government, not only on issues having to do with the pipelines, but also on other issues that require the communities' vigilant action around the pipelines in Abuja.

In Abuja, the people have endured pipeline vandalism-induced ground water contamination. Taking advantage of their united front, the communities have campaigned for compensation. They have also protested, albeit unsuccessfully, against other problems, such as pipeline-induced fire outbreaks, impediments to community growth and expansion patterns, and governmental restriction on their freedom of movement (Adeola, 2000; Osgood, 1974) .

7.6 Otukpo communities and the ROW

Otukpo is located in the southern part of Benue State, which is in the north-central region of Nigeria. A major petroleum pipeline called the 2E pipeline system traverses urban and rural Otukpo. It originates from Port Harcourt in the Niger Delta region and runs through Aba and Enugu in the South Eastern region to Otukpo and Makurdi in the north central region, terminating in Yola in the North East region.
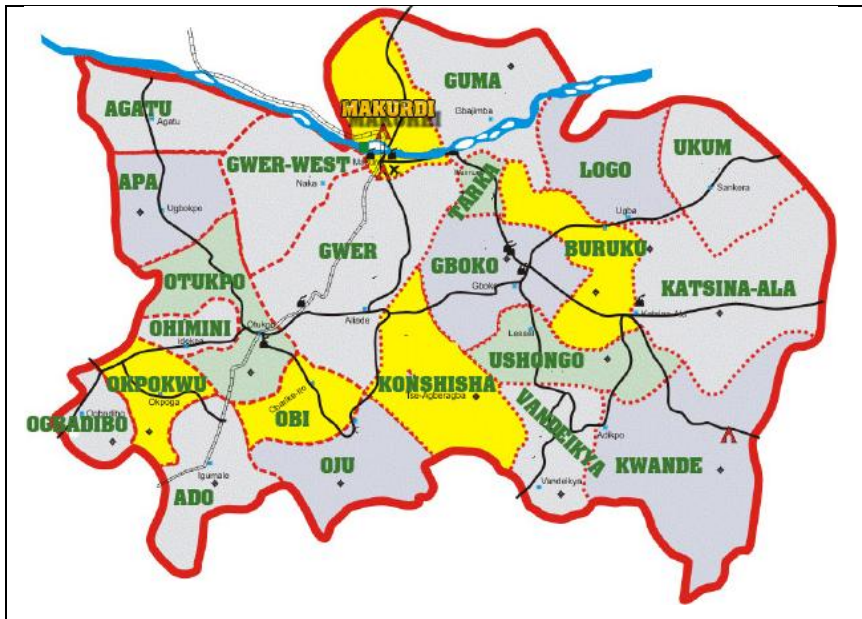
Figure 28: Map of Benue State showing Otukpo communities

Source: Independent National Electoral Commission

7.6.1 Age and occupation of population in Otukpo

In Otukpo, whose position within Benue state is shown in Figure 28, 146 structured interview questionnaires were administered. Respondents were selected from every fifth household as the researcher walked along the 50m ROW in the pipeline communities. The interview questionnaires were administered to the first adult aged from 18 to 60 and over encountered in the randomly selected households. At the end of the field survey exercise in Otukpo, a 100% rate of return was recorded. This high rate of return was due to the direct approach adopted. The researcher and research assistants read the questions out to respondents and ticked the options they selected as appropriate.

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Figure 29: Occupational distribution in Otukpo

Figure 30: Academic attainment in Otukpo
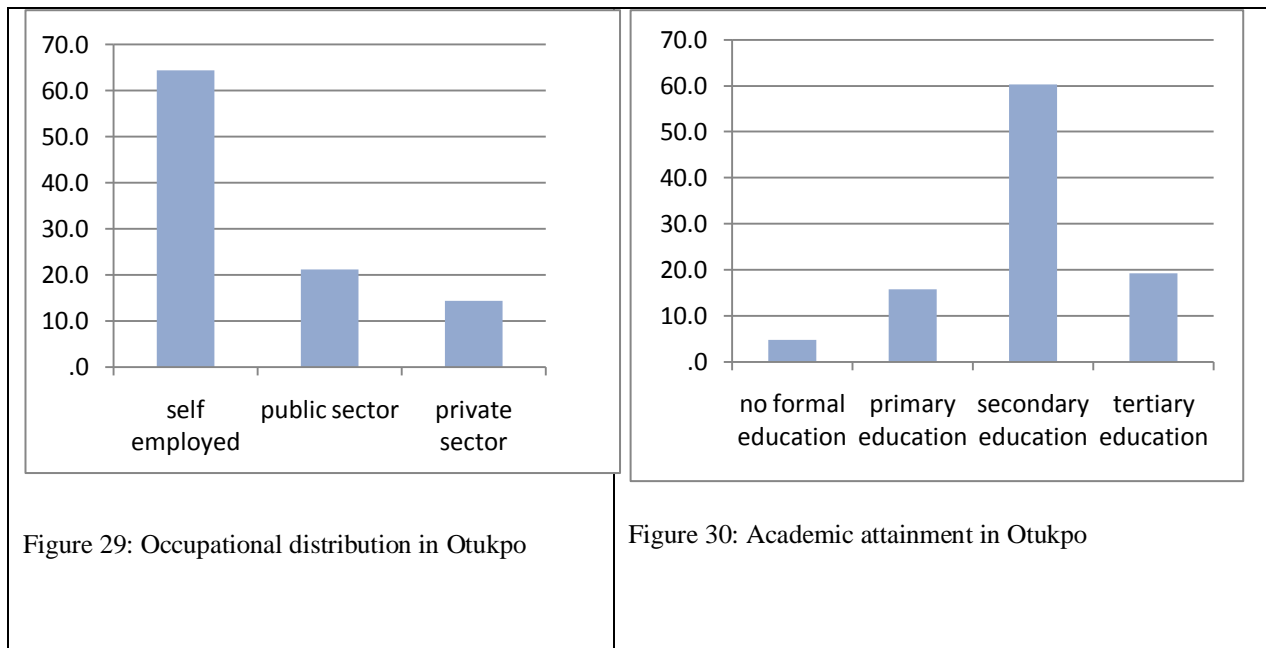
Source: Fieldwork, (March) 2009

As can be seen in Figures 29 and 30, although above 60% of the respondents in Otukpo attained a basic secondary level of education, about 64% of the respondents were employed in the agrarian informal sector of the local economy, which has lost substantial parts of its arable land to oil spillage and contamination caused by vandalism (1968). Asked about the level of satisfaction which their agrarian employment gave them, a respondent said:

> [...] *engaging in the agrarian means of subsistence was a last resort because the pipeline and the frequent oil spillage it has caused have made farming less profitable compared to non-agricultural occupations which are difficult to find. Because of the dwindling fortunes this has brought to bear on the farmers, they are branded the lowest in rank in the community, compared to their lucky kinsmen in the formal private or public sector employment (Youth leader in Otukpo, 30/03/2009).*

The study shows that over 70% of respondents between the ages of 18-29 in the urban and rural Otukpo Communities are self employed. As mentioned in the introductory section of this chapter, employed in Nigeria are classified mostly as under-employed (Department for International Development, 2008; World Bank, 2004). The people in this case study expressed eagerness to be engaged by the government and the International Oil Companies for the protection of pipelines

within their communities. Levels of awareness about petroleum pipelines in these communities were high (96%). Similarly, over 93% of the respondents were aware of appropriate national laws meant for pipeline protection, yet with a similarly high rate of encroachment reported in Otukpo communities.

7.6.2 Pipeline failure in Otukpo

The results of data analyses from Otukpo indicate that vandalism accounted for more pipeline accidents than all other accidents involving hazardous liquid and natural gas put together. Correspondingly, corrosion and other natural causes of pipeline failure contributed only a small proportion of accidents.

Natural and man-made causes of damage to pipeline in Otukpo, as revealed by this research, include lightning, heavy rains and flood, excavation by the operator, excavation by a third party, being struck by vehicles not related to excavation, rupture of previously damaged pipe, and vandalism. Data from the fieldwork show that petroleum pipeline vandalism in Otukpo is the greatest threat not only to the pipelines, but to the communities they traverse as well. Some of the failures occurred, however, owing to ageing pipes that had outlived their life span.

7.6.3 Encroachments on the ROW

The field survey revealed that over 41% of the respondents encroached on either side of the pipeline ROW while a further 26% were not sure if they had encroached on the pipelines in Otukpo. Upon physical measurement, however, it was confirmed that most of the respondents who were not sure of the distance were actually within 25m of the pipeline. This research also confirmed that human dwellings situated close to utility lines, such as electricity and railways, portend serious threats to their occupants. In the absence of established demarcation and control of physical development in line with the statutory 25m ROW, physical development and other high risk activities had entered into the vicinity of the pipeline in apparent disregard of the inherent danger to the properties and lives within the encroachment.

Social and economic processes propelled by urban and regional underpinnings have operated to prevent the legal and administrative frameworks which the locals see as elitist from finding expression in any blueprints for protecting the pipelines within

the communities in Otukpo. The system of planning and environmental management in Otukpo derives its authority mainly from sub-national statutes, which do not have jurisdiction for the management of the pipelines and associated ROW as these are within the exclusive preserve of federal authorities.

The lack of coordination between the federal and sub-national authorities has rendered ineffective the provision of the pipeline law in Otukpo. This has hampered collaboration among stakeholders in implementing administrative policies and legal frameworks that engender the building of a mutually reinforcing synergy in the sensitisation of all stakeholders to the common goal of sustainably managing the ROW for the common good of all. In the past decade, the issue of crisis-free management of pipelines' ROW has become one for which much interest has been generated in an apparent attempt to engender a synergy that would make the pipelines useful to their immediate communities and environment.

Figure 31: Proximity of buildings to pipelines in Otukpo

Source: Fieldwork (March 2009)

As illustrated in Figure 31, planned commercial developments were also seen within the ROW of the pipeline, with no visible sign of remedial measures by the authorities to either invoke the statutory ROW provision or to sensitise the occupants to the potential damage which a burst pipeline would cause. Ground water

contamination was reported in three rural communities in Otukpo, polluting the sources of potable water in the communities. Contaminations were reported to have resulted from the seepage of petroleum products from damaged pipes. Closely linked to the human safety concern of encroachment of settlements on the ROW is the prospect of environmental damage associated with every reported case of encroachment.
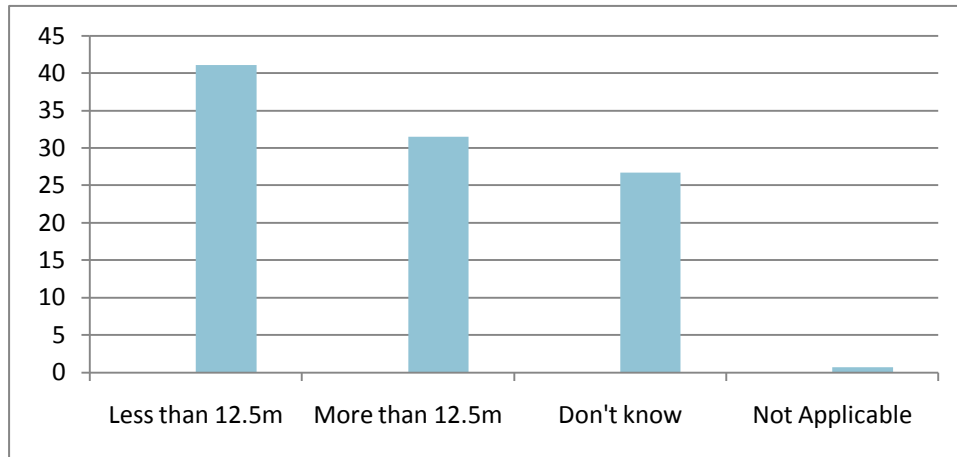
Figure 32: Percentage of dwelling units encroaching on the ROW in Otukpo

Source: Fieldwork 2009

Since the pipeline project was completed in Otukpo over three decades ago, cases of encroachment have steadily increased. As seen in Figure 32, over 40% of the 146 respondents had their dwelling units within the statutorily prohibited ROW. Many of the locals involved in encroachment said that they only realised that they were living within the ROW after they had sunk their hard earned money into acquiring and building their dwellings. They complained of the inability of the planning authorities to have advised them of the pipelines before embarking on the construction work. A development already associated by this research in chapter six to lack of collaboration amongst the different levels of government in Nigeria.

In Otukpo, saving towards property development is a once in a life time investment which has confined many locals to their current properties. Poverty has also prevented people from relocating away from the pipelines. This situation has further exposed these already endangered pipeline community members to other high risk activities, like the misappropriation of oil from vandalised pipes. About 40% of the

affected community members responding to the survey also cross the pipelines daily. Crossing of the ROW at unauthorised points also reported to have led to locals being caught up in infernos caused by explosions and this has resulted in environmental damage and loss of life (Onuoha, 2007).

Figure 33: High Risk Activities within 12.5m of Pipeline in Otukpo

Source: Fieldwork 2009

As illustrated in Figure 33, oblivious of the dangers from the rarely-maintained pipelines in Otukpo, the locals still operated high risk enterprises such as car repair workshops and garages right on the ground surface immediately above the pipeline. This research found that many owners of residential and commercial properties had not relocated because they were still awaiting payment of compensation from the government. While over 40% of survey respondents who owned properties within the ROW were certain that compensation would never be paid to them, about 28% of those affected were not sure if compensation had been paid to the heads of their households at the time the compulsory acquisition of their lands was effected. As reported by Adams (1988), this research confirmed that payment of compensation for lands acquired for pipeline projects and oil related operations was restricted to commercially-cultivated trees, because the Land Use Act vested land in Nigeria in

the control of the state Governor. The Act makes the issue of payment of compensation for land acquired by government a remedy that is only available to the community land owners in equity at the discretion of the government. Similarly, there are no laws providing for compensation for oil spills and other damage that is the direct offshoot of explosions caused by pipeline ruptures or vandalism. As a result, locals and communities affected by oil spills and explosions are left with no legal relief within the purview of national courts.

This research has also shown that in Northern Nigeria, analysis of the impact of oil on security has been focused on political and economic conflicts rather than on how disasters associated with oil pipeline vandalism have impacted directly on human lives and communities. As a result, high risk activities such as the location of residential and commercial premises within 25m of the pipeline, as shown in Figure 30, have escalated incidences of pipeline vandalism in Otukpo in the past decade. Many owners of residential and business premises in Otukpo expressed their willingness to move away from the danger zone close to the pipelines, but were inhibited from doing so by poverty (World Bank, 2004).

7.6.4 The communities and the pipeline in Otukpo

According to Omeje (2005), Nigeria's political economy is shaped by the oil industry and its derivatives, including pipelines. He further contends that agitation regarding oil rents and compensation for land acquired for oil infrastructure development is going to continue in the courts of equity in the absence of competent legal channels through which those affected might vent their accumulated grievances.

This research revealed that in Otukpo, due to new construction and the renewal of existing oil infrastructure, pipelines have continued to grow in popularity and gain acceptance in the municipality, where the vandalism rate is not very high compared to rural areas. Because Otukpo is predominantly composed of rural communities, vandalism and the associated impact on the communities' natural resources has pitched people against their pipelines, the government and the oil companies. This study found that over 27% of the respondents in Otukpo were not happy that the local stretch of pipeline had caused the range of environmental problems that now

engaged their communities. They lamented that their source of drinking water was almost always contaminated by the seepage of oil from damaged pipes and claimed that oil thieves had often held the communities close to the pipelines to ransom.

The oil thieves, according to the community members, often went about armed in their communities in order to repel attempts by the community members to challenge them, intimidating the community members in the process. The problem of vandalism is rife in Otukpo communities, as reported by Onuoha. Over 67% of the respondents had experienced vandalism and about another 10.3% of the respondents attributed the vandalism experienced over time to people from their native communities. The level of reporting of lives of loved ones lost to pipeline vandalism and its associated explosions was high in Otukpo.

In Otukpo, the community members' only approach to the problem had been *ad hoc* and reactionary, taking place long after pipeline vandalism incidents had run their full course, leaving trails of environmental damage and impacting negatively on the environment. In Otukpo, over 42% of the respondents had lost loved ones in the past decade to vandalism-induced problems. While some of the dead had been caught up in altercations between the vandals and the police, investigation in the communities shows many others lost their lives in explosions while scavenging the spoils of vandalism and in the process where caught up by explosions. Public and private property had been lost to pipeline vandalism and the explosions that often result. Analyses of the responses of those surveyed in Otukpo also show that 24% had lost property in the past decade. This loss of property, in addition to the feeling of injustice felt by local people due to the government's non-payment of compensation, had further agitated the communities against the pipelines.

This study also found that there were no collaborative arrangements for the community members and the government to act jointly in addressing the problems of vandalism in Otukpo. This situation has created a loophole that criminal elements in the society have exploited to engage in vandalism and theft of public goods that are transported via the pipelines. This has resulted in growing lawlessness in communities, as over 61% of the respondents in Otukpo said that they would protest against the perceived bad policies of the government by engaging in acts of vandalism.
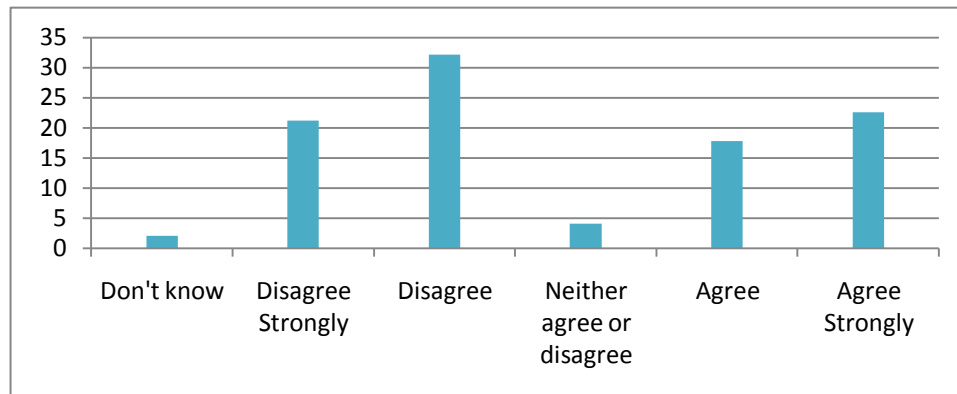
Figure 34: Pipelines separating communities in Otukpo

Source: Fieldwork 2009

As illustrated in Figure 34, over 40% of the respondents agreed that rather than improving the access of the community. Furthermore, in these communities, the pipelines have not improved access by the people to the public goods (Petroleum products) transports as scarcity of petroleum products was commonly observed in the communities in this case study. On the contrary, investigation shows that the pipelines separated them from neighbouring communities with whom they have affinities and interacted freely before the pipeline project was executed. Over 70% of the community members argued that the pipeline project had imposed a state of insecurity on them, making them devote time and resources that could have been used for other productive activities for dealing with threats emanating from the pipeline. They lamented that since the pipeline project was completed, they had either had their water sources contaminated by oil spill from vandalised pipes, had their arable lands contaminated or suffered restriction of movement owing to the activities of armed oil thieves.

7.6.5 Oil Spillage in Otukpo

This research revealed that members of pipeline communities had been so impoverished by a plethora of pipeline problems that many aggrieved people in the communities had subsequently taken to seeking out damaged pipes, so they could scavenge the spoils of vandalism, with many of them dying in the process.

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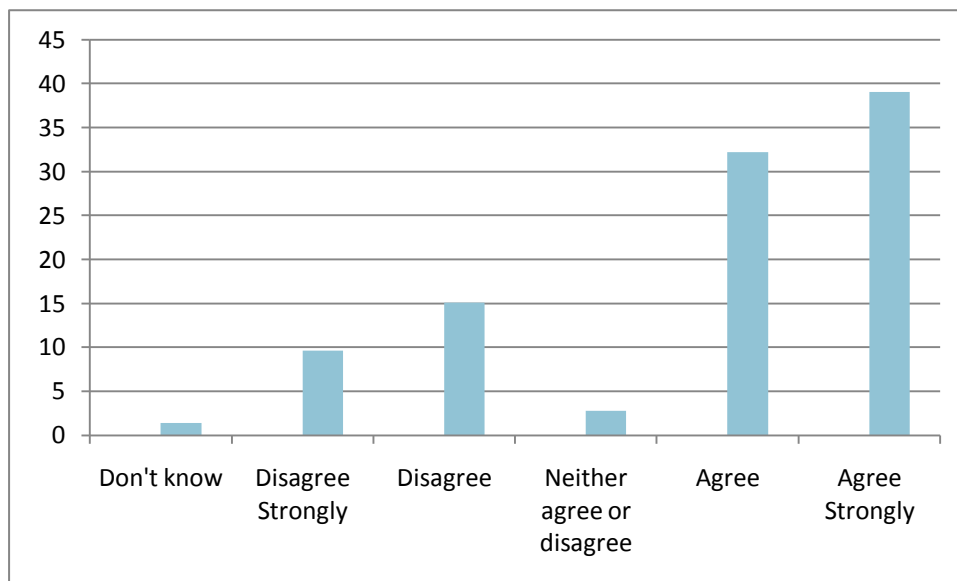
Figure 35: Oil spillage caused by pipeline vandalism in communities

Source: Fieldwork 2009

Pipeline vandalism has caused many oil spills in Otukpo, polluting the environment in the process, which people said was because they were unfortunate to have the pipelines passing through their land. As illustrated in Figure 36, over 70% of the respondents attributed the incessant cases of oil spillage to the activities of vandals invading the communities.

7.6.6 Community members as stakeholders in Otukpo

The community members had become increasingly frustrated with their current exclusion from the sporadic arrangements for the management of the pipelines whose failures have resulted in damage to property, the environment and in, extreme cases, human casualties. They expressed worry that the near absence of a framework for the management of the pipelines' ROW in their community had attracted violent vandalism, a factor which had been alien to the community in the years before their land was taken for the pipeline project.

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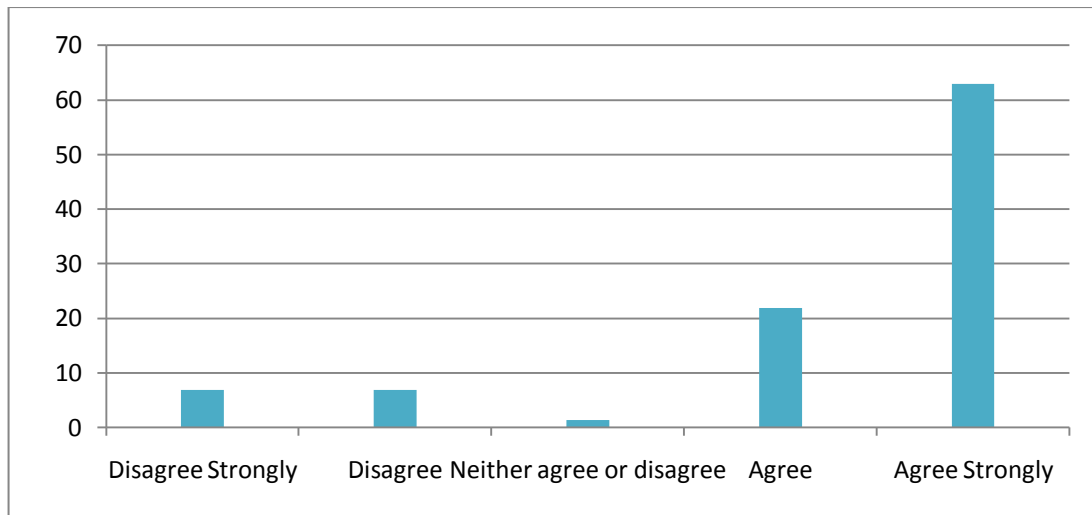
Figure 36: Community members to participate in ROW management in Otukpo

Source: Fieldwork 2009

As shown in Figure 36, about 63% of the respondents strongly agreed to the community participating in the management of the pipelines in Otukpo. The community members were eager to be part of any effort at finding a workable proactive solution to the problems of management of the ROW. Over 45% of the respondents complained that their sacred community lands had been lost to the pipeline project. A good proportion of the remaining sacred land, which according to the respondents is culturally very dear to them, was being desecrated by non community members whose attraction to the community was the pipeline.

Furthermore, the people said that the loss of their sacred land to the pipeline project has impacted negatively on the spiritual wellbeing of the community because substantial parts of the sacred land had visited occasionally before has been obliterated. Many members voiced their frustration that the parts of sacred community land left after the greater part was taken by the pipeline project were still being desecrated by pipeline vandals, thereby threatening the foundation of their traditional belief system, which is rooted in the sanctity of parts of the community land. Over 30% of the members strongly agreed that the activities of the vandals had affected their treasured community lands. Similarly, 40% of them agreed that these activities had impacted on their spiritual wellbeing.

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Figure 37: Holes made by vandals in search of pipeline in Otukpo

Source: Fieldwork 2009

As seen in Figure 37, the vandals destroy rural roads in Otukpo communities. This they do by digging on roads that are already in a state of disrepair. This has made it difficult for some of the community members to move their wares to the markets, and this situation has, they stated, caused damage to their sacred lands and the roads, which in turn has affected their community belief system. Some of the adherents of their traditional religion had been affected by their sacred place of worship being desecrated by criminals attracted by the pipeline. This group of people, according to the community, do not accede to the restraints the traditional belief system imposes on them not to pursue undertakings that run contrary to societal norms.

7.6.7 Effects of the pipeline in Otukpo communities

As the community members insisted, most of the public health hazards that occurred subsequent to the pipeline project are attributable to it. Over 80% of the respondents said that the pipeline constituted a public health hazard to the community, stating that a great deal of contamination of underground water that the community had suffered was due to pipeline vandalism.

Meaningful participation of the ROW stakeholders, throughout a collaborative management process domiciled within the communities traversed by the pipelines in Otukpo, will be an effective approach for ROW management. In Otukpo, enabling a

meaningful participation will defuse the strong notion held by over 50% of the respondents that ROW destroys community amenities. The community would come to see the pipeline as part of the community's amenities and so be involved in its protection. An upsurge in criminal activity is another problem which the pipeline has caused in Otukpo. The communities attribute the rise in hostage-taking for ransom to the introduction of the pipelines about three decades ago. Over 30% of the respondents expressed the view that the pipelines in their communities had caused a surge in criminal activities which had often led to the destruction of the community landscape and caused unpleasant scenarios.

In Otukpo, over 20% of the people said that the environment around their surroundings was fast changing for the worse since the pipelines and other associated activities had invaded their otherwise serene and naturally robust environment. As a consequence, many of them now lived with the notion that their community landscape had been permanently impaired. Because of this, the community's hopes that the pipeline would become a source of blessing for the community were waning. They contested the idea that pipelines, being a mode of transportation, had improved access for communities in Otukpo. Instead, the pipeline had imposed restrictions that, over time, estranged them from their neighbouring communities.

According to the respondents, and as similarly reported by Nnah and Owei (2005), the ROW have only increased travel distances between communities on opposite sides. The people have to travel long distances to designated crossing points, especially in instances where such points are far away from the communities. The intercommunity movement barrier imposed by the pipelines has progressively reduced the otherwise vibrant interactions that these communities had before the advent of the pipelines that now separate them.

Communities tend to interact with other communities that they can reach over a short distance. Over 30% of the respondents disagreed with the proposition that ROW foster inter-community access. Community infrastructure such as open spaces and stadia that are located far away from the would-be users are certain to record low patronage because interested community members may be constrained by increased distance.

The question of public safety hazards as relates to the pipeline has been of concern to the people of Otukpo. This has influenced people's attitude towards the pipeline. About 50% of the members of this community submitted that the pipelines constitute a public health hazard to the community. Identification of potential hazards is a critical step towards alerting a community to prepare for the unforeseen destruction a disaster, either natural or man-made, would bring about (Porter and Savigny, 2002b).

The communities had witnessed several hazardous outbursts from the pipeline and noted their vulnerability to further hazards in the continuing uncoordinated state of affairs in the management of the ROWs. The people were cognisant of the negative externalities that the pipeline problems had foisted on them; they have, however, not been able to coordinate with other stakeholders to activate a programme that articulates community knowledge about pipeline failings and moribund statutory instruments within an operational framework for the management of the ROW in Otukpo.

This research finds that attention has not been paid to the problem of soil and water contamination caused by pipeline vandalism in Otukpo. In the several recorded cases, steps had never been taken to deploy bioremediation so that the contaminated water and soil can be useful to the people. Remedial efforts had only revolved around the repair of the pipeline, so that the strategic economic interest of transporting products through the pipelines resumes as soon as the incidence is reported, while the people wait on the natural ecosystem to restore their contaminated land. The hazardous externalities of the pipelines to public safety have also been reflected in the sporadic outbreaks of fire in the communities. Over 72% of the respondents alluded to the loss of grazing reserves and fallow farmlands due to explosions caused by pipeline vandalism in Otukpo.

7.6.8 Pipelines and community growth pattern in Otukpo

Pipelines have distorted the growth pattern of most of the communities in Otukpo. Community expansion is not legally permitted within the ROW of the pipeline. The direction of expansion of the community must necessarily move away from the barrier imposed by the pipeline. Over 31% of the respondents said that the barrier imposed on the communities' expansion by the pipelines has not distorted the

growth pattern of the communities. The communities' growth sprawls organically in the direction of least resistance. According to them, the communities never had any pre-pipeline development plan that projects growth in the direction of the pipeline. Organic communities' growth patterns are not pre-ordered and so would respond to growth challenges as they unfold (Done, 1982).

In Otukpo, both before and after the pipelines were laid, the communities have not had any structured development plans to dictate the direction of their physical development. Crossing the pipeline forms part of the daily routine of about 35% of the respondents and 36% of those claiming that the ROW had not been beneficial to them personally.

7.7 Network of petroleum pipeline in southern Nigeria

The fieldwork was undertaken in two states traversed by pipelines in the southern region of Nigeria. The southern Nigerian region was a 20th century British protectorate that was formed in 1900 from the union of the Niger Coast Protectorate with other territories chartered by the Royal Niger Company, which operated up to the River Niger below Lokoja. With the addition of the colony around Lagos in 1906, the territory was officially renamed the Colony and Protectorate of Southern Nigeria by the British colonial authority. In 1914, the Southern Protectorate was amalgamated with the Northern Protectorate to form a single Colony of Nigeria. The southern region of Nigeria is today made up of three geopolitical zones, namely the south southern zone and the south western zone, both of which have six states each,[21] and the south eastern zone with five states. Enugu State is one of the five states in the south eastern zone of the country.

7.8. Pipeline problems in Enugu state

Unlike the other geopolitical zones in the southern region of the country, the south eastern zone is made up of five states. Enugu, which is one of the states in the south eastern zone, was created on August 27, 1991. The city of Enugu owes its geopolitical significance to the discovery of coal in 1909 by a team of British geologists. The discovery of the solid mineral in the area brought about the

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[21] A state is a sub-national entity of Nigeria governed by a Governor.

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emergence of a permanent cosmopolitan settlement which influenced the construction of a railway line to link the Enugu coal fields with the sea port in Port Harcourt, for export of the fuel.

By 1917, Enugu had acquired township status and assumed strategic importance to British interests. Foreign businesses began to move into Enugu, the most notable of which were John Holt, Kingsway Stores, United Bank of West Africa and the United Africa Company. By 1929, Enugu had become the capital

of the former Eastern Region, which has since then retained its old status as the regional industrial and business hub, as well as the political capital and rallying point of the Igbo people.
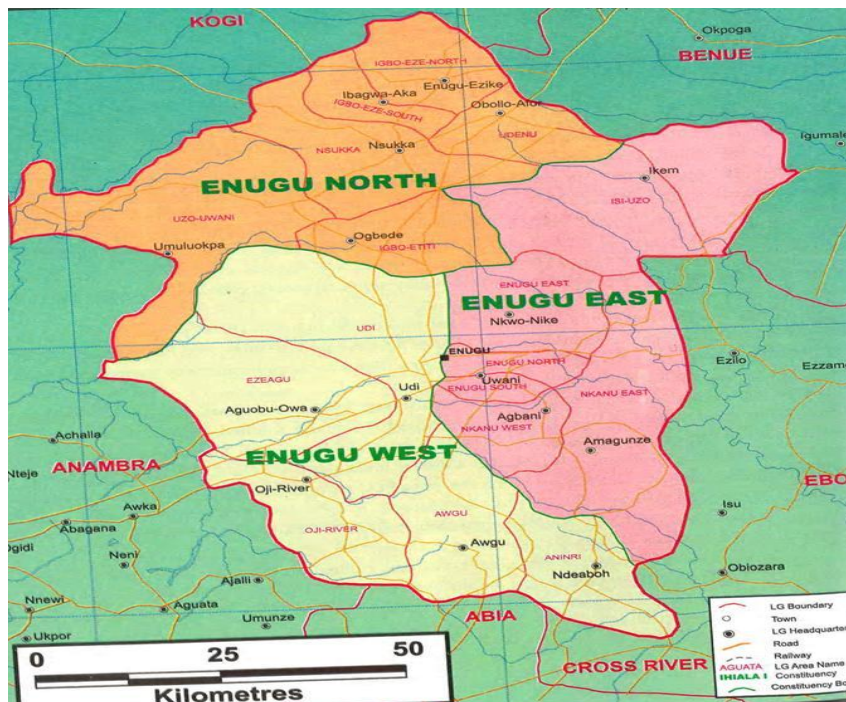
Figure 38: Map of Enugu

Source: Independent National Electoral Commission 2008

Enugu Urban, as presently constituted, is the capital of Enugu State. The Enugu territory shown in Figure 38 lies between longitude 07° 2'E and 07° 37'E; and between Latitude $06^{o}21$'E and $06^{o}30$'E and covers approximately 79.2km^2. Enugu lies roughly 254.5m above sea level (Ubani, 2004). Having served as the headquarters and capital city for a number of governments, from the colonial era to

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the present day, Enugu has continued to grow both in population and spatial coverage. Presently the Enugu urban area is made up of three local government areas, namely, Enugu North, Enugu East and Enugu West local government areas. The settlements in these local government areas which are urban and peripheral have been knitted together to form Enugu Urban, the Capital city of Enugu State.

7.8.1 The ROW and the people of Enugu

The environment in Enugu is replete with developmental problems. As is the case with many Nigerian towns and cities, despite the adoption of physical planning, Enugu has witnessed unprecedented land use problems (Nnah and Owei, 2005). These problems, which have manifested in the current rate of urbanisation in Enugu, have extended to the ROW of petroleum pipelines and appear to have transcended the physical planning efforts of the authorities (Nnah and Owei, 2005; Mutatkar, 1995).

The efforts of the government in providing infrastructure and services in Enugu have not kept pace with urban expansion. As a result, individuals and corporate developers have stepped in to fill the infrastructure gap. This development encouraged urban sprawl in Enugu, a situation that has triggered physical development outside the purview of planning control, with all its associated problems. As reported by Odoh and Iyi (2005), the unabated sprawl of physical development in Enugu, under the pressure of private sector for-rent developments, has resulted in inadequate provision of infrastructure and other neighbourhood services. This has produced an organic urban and rural growth pattern which made sprawling encroachments on the ROW of the pipelines that traverse Enugu. Many urban and rural environmental problems have remained unresolved, and many others are being caused because physical developments at the urban periphery and the rural areas in Enugu are not controlled. As a result, the peripheral rural areas have sprawled onto the ROW. Consequently, the owners and occupants of many of the encroaching physical developments are still oblivious to the aged pipeline within dangerous proximity to them and the horror that could result if the pipeline fails owing to vandalism or ageing-induced corrosion (Odoh and Iyi, 2005).

Enugu is a major hub of the distribution of petroleum products through the pipelines to different parts of the country. Crude oil is also transported through the pipelines in Enugu to the refinery in Kaduna for refining and distribution to consumers in the northern region of the country. Major product storage and distribution depots and three systems of pipeline networks traverse the Enugu landscape. These pipeline systems include the Port Harcourt-Aba-Enugu-Makurdi known as System 22E, the Port Harcourt-Aba-Enugu-Makurdi-Yola network known as the 2EX System and the System 2CXa that all run from Enugu to Auchi on the midland fringes of the Niger River close to Idah[22] Township in Kogi State.

Analysis of the problems of ROW encroachment in Enugu looks at the intensity and characteristics of encroachments in the parts of the city traversed by the pipeline, evaluating the spatial extent of the encroachments and the environmental and socio-economic effects on the people.

7.8.2 Awareness about statutory protection of the ROW

There was a high level of public awareness about the pipelines and the law protecting their ROW in Enugu. This high level of awareness is attributed to the widespread incidence of vandalism in the urban and peripheral rural areas of Enugu. The frequency of occurrence of incidences of vandalism in Enugu appears to correspond with the level of awareness of the law meant to protect the ROW in Enugu.

Over 95% of the respondents within the pipeline communities in Enugu were aware of the existence of the pipelines within their neighbourhoods. Mention of the petroleum pipeline in Enugu elicited different reactions from the inhabitants of the communities it traversed. To some, it was a reminder of the loss of their loved ones in a vandalism-induced pipeline explosion, to others it was a reminder of painful raids by security operatives and to yet another group it was a reminder of the painful loss of property to fire and explosions caused by pipeline vandalism.

This research showed that 84% of the respondents were aware that national laws protect the ROW. This knowledge has undoubtedly not deterred acts of pipeline

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[22] Auchi, Aba, Idah and Makurdi are major towns traversed by petroleum pipelines in Nigeria.

vandalism and attempts by local residents to salvage fuel from vandalised pipelines have been revealed by this research revealed as constituting one of the major causes of mortality in Enugu.

Furthermore, Chukuemeka and Amuezeuoke (2005) report that from the moment people with money are arrested, the police, apparently acting in concert, ensure that the matter is taken to court immediately and the next day the perpetrators are back in business. This explains why vandalism thrives, even under the prohibition of the law. In spite of the seemingly high level of awareness about the pipelines and the laws protecting their ROW among the communities, the frequency of inimical activities connected with the pipelines has not reduced.

Figure 39: A major petroleum depot put out of use by vandalism

Source: Fieldwork 2009

As seen in Figure 39, the main distribuation depot in Enugu, which hitherto was a beehive of commercial activity and supplied products to the south eastern region and other parts of the country, was almost empty because it has become impossible for oil to be pumped to it from the refineries and other import through the pipelines, owing to the incessant activities of the vandals, whose operations have persisted in spite of the anti-vandalism campaigns of the Enugu authorities.

Furthermore, different categories of employees find employment in the Enugu depot. One such category is the Members of the Petroleum Tanker Drivers Union. This group of tanker drivers have become unemployed because petroleum products are no

longer supplied through the depot, owing to frequent cases of vandalism on the pipelines that supplied products to the depot. A tanker driver who lost his job in the depot because of vandalism said:

> *[...] activities of the pipeline vandals necessitated the decision of the Nigerian National Petroleum Cooperation to stop pumping of petroleum products through the pipelines. The result of which has been the dearth of business activities at the Enugu major distribution depot. The hundreds of tankers that hitherto lifted various products from the depot to different parts of the country for dispensing no longer patronise the depot for lack of products. The ancillary business activities such as banking, insurance and grocery have disappeared as a direct consequence and the multitudes that worked at the depot were put back to the already saturated the labour market in Enugu (Petroleum Tanker Drivers' Association, Enugu Depot Branch, 24/04/2009).*

The statements above show that the problem of vandalism goes beyond damage to the pipelines in Enugu. It is also responsible for the loss of employment by many people who were employed at Enugu depot.

7.8.3 Encroachment on the ROW in Enugu

This research revealed that the dearth of activities at the depots and the resultant loss of gainful employment for youths who worked in the refineries have further added to the already teeming mass of idle hands in Enugu, who are vulnerable to recruitment by master vandals, preying on idle unemployed youths desperate to make a living. The issue of encroachment on the ROW in Enugu is a serious problem because some of the people whose buildings have encroached upon the ROW are not aware that they are living within the statutory ROW of a petroleum pipeline. Those who were aware that they were encroaching, but had still not relocated from the ROW, had the excuse that they had not been paid compensation for the land taken from them for the pipeline project. This group insinuated that their continuous occupation would sensitise the government to their obligation to pay them for the land taken from them and also let the government know that they need government support to resettle away from the hazard prone ROW. They insisted that it was the fundamental duty of the government to relocate its citizens away from hazard-prone areas, not only along the pipeline but in any area within the national boundary of the country.
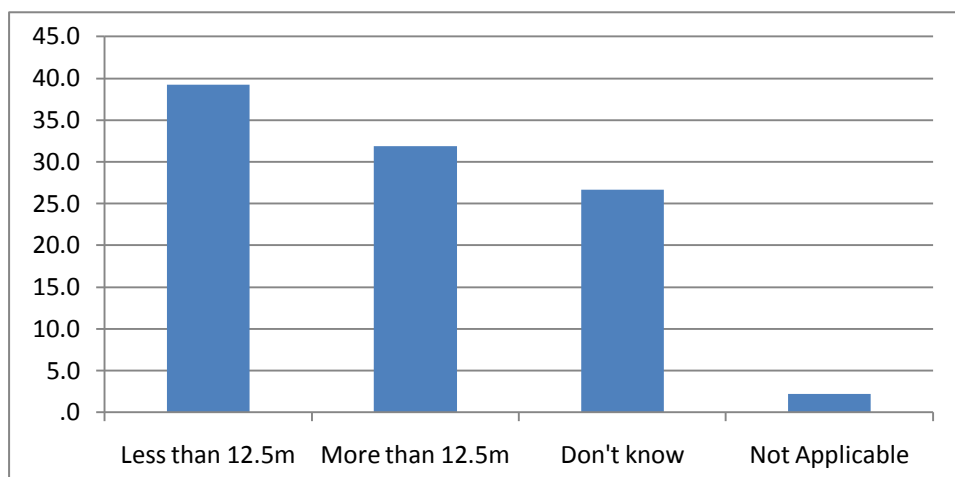
Figure 40: Encroachment on the ROW of pipelines in Enugu

Source: Fieldwork 2009

As seen in Figure 40, encroachment on the ROW was widespread in Enugu. About 40% of the respondents were sure that their houses encroached onto the statutory ROW; while another 27% of the respondents whose houses were equally encroaching did not know that they were living within the prohibited area, at apparent risk of the likely explosion that vandalism or failure could cause.

This study also reveals that petroleum pipelines, though a means of transportation in the south eastern region, have not improved access for inter-community movement in many areas of Enugu. On the contrary, they have imposed a statutory restriction, according to which people in the communities have crossing privileges only at designated points, that in the majority of cases are far away from crossing points that would be convenient to the people. Over 51% of the respondents cross the pipelines daily in pursuance of their livelihoods, and they are rarely taken notice of by the law.

The level of compensation payment to community members affected by the pipeline project in Enugu was significantly low. Less than 20% of the respondents had received compensation from the government, a situation community members said had affected their tolerance for the pipelines. They further said that the pipelines usurped their valued land and continued to be an attraction for violent criminal activities. Over 63% of the respondents were enthusiastic regarding the representation by the pipelines and other petroleum installations of a federal presence in Enugu. Similarly, they said that having the pipelines within their

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communities makes those of them owed compensation hopeful that it will be paid. According to them, the pipeline sensitises generation after generation in the communities to the fact that the authorities are indebted to them. They believe that, through peaceful agitation, the debt owed them by the government will eventually be redeemed.

Furthermore, investigations show that Enugu society has suffered heavy damage from the pipeline. Most social and environmental problems bedevilling the communities were attributed to pipeline vandalism. The associated manifestation of fire disaster and poverty in the communities reveals more than it conceals as to the magnitude of the uncertainties to which the pipelines have exposed the people. As recounted by over 63% of the Enugu respondents, vandalism occurs with high frequency. Acts of vandalism have also been reported to be behind the colossal mortality and other losses in property and near permanent damage to the environment in these communities. In the 1990s, vandals in Enugu who were mainly unemployed youths operating in remote areas and communities traversed by the oil pipelines, punctured the pipes or took advantage of ruptured pipes to siphon petroleum products into drums, plastic containers or storage cans and sold them on the black market.

This research also revealed that in Enugu, poor villagers and other residents of the pipeline communities gathered at the site of a rupture and use clothes or foam to soak the products from dug-out earth holes on the pipelines and squeeze the contents into plastic buckets and containers, which they then sold on to unsuspecting motorists. Given this situation, the era recorded quite insignificant cases of pipeline vandalism. Statistics obtained from the Enugu office of the national oil company show that between 1993 and 1998, there were only 146 cases of vandalism in the conurbation of Enugu. But in the year 2000 alone, there were over 200 recorded cases, with many of the community members losing loved ones to the ensuing explosions and the subsequent infernos, and about 20% of the respondents reporting loss of loved ones to pipeline vandalism-related accidents with a colossal loss of property also resulting.

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7.8.4 Enugu communities separated by pipelines

In Enugu, the pipelines were routed through communities that hitherto existed as a single nucleated settlement. This created a general feeling of alienation among the people, as parts of communities on either sides of the introduced ROW evolved into semi-autonomous and, in some cases, autonomous communities, differing in heterogeneous identity to their once integral state, due to their separation by the pipeline.

It also impacted upon the communities' otherwise unrestricted, organic and homogeneous processes of socialisation (Onuoha, 2008c). Recounting the separating effects of the pipelines on the communities, about 20% of the respondents affirmed that many of the communities in Enugu were affected negatively by the separating effects of the pipelines, which generated the growth pattern of the separated communities in directions other than that of the pipeline. Similarly, about 87% of the respondents felt that the pipelines had plunged the communities into impoverishment, a development that has generated odium for the pipelines.

Aprioku (2003) asserted that the pipelines are the only reason why oil spill is mentioned in Enugu, since crude oil is not produced there. Aprioku further said that the Enugu people, who are mostly rural, have only meagre resources with which they can respond to the hazard of oil spill. The coal mine which used to be a major source of employment for the people is now closed owing to the lack of demand for coal; as a result, there is a manifest lack of employment in Enugu. This was also alluded to by the community members, 37% of whom agreed that the unemployed among them were responsible for some isolated cases of pipeline vandalism.

The communities along the ROW in Enugu feel that the pipeline is a source of problems for communities. Over 70% of the respondents were unanimous in agreeing that the pipeline portends a threat to the environmental and to the socioeconomic wellbeing of the people. They further averred that the pipelines compromised some of the sacred lands in the communities which represented the basis of their traditional belief systems (Okafor, 2003). It was claimed that portions

of community lands hitherto regarded as evil forests[23] were traversed by the pipelines, providing inroads into forests that only the traditional priests visited at designated times of the year to conduct rituals and other sacrifices for the general wellbeing of the people (Manus, 2007). It was said that the traverse of the pipelines through these forests vitiated the belief some of the locals had in their native gods, a development that has on a continuous basis propelled the people towards Christianity and eroded many valued local traditions.

As Manus puts it:

> [*The] feeling of the sacred is quite a ubiquitous experience in Igbo land because it renews the people in conservatism. In stark contrast to the dualism present in Greek antiquity and Western philosophy, the Igbo view of life is dependent on the gods and rampaging deities that rule the affairs of man. Evil forests abound and are considered the abode of dangerous spirits and malignant deities in Igbo land* (Manus, 2007: page 6).

This research also revealed not only that many designated sacred lands of the people in Enugu have been desecrated by perpetual vandalism of the pipelines traversing the Enugu conurbation, but also that violent criminal activities have been introduced and promoted in these communities. As a result, the safety, amenity and ambience of the communities have been affected. The ROW have also generated a seeming eye-sore in these communities and the peoples are restrained by law from doing anything about it (National Assembly Nigeria, 1990e).

7.8.5 Pipeline and the Enugu landscape

According to Chineke (2009), the incessant acts of vandalism on the pipelines have not only destroyed the beautiful landscape, they have also been linked to disruptions in electric power supply. The flow of natural gas to the electric power stations that supplied power to these communities suffer from intermittent disruptions that prevent the plants from functioning for the greater parts of the day, translating into electric power blackouts for communities that were already weighed down by the burden of having to adjust to the invasion of violent criminals attracted by the

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[23] Evil forests are forests regarded in traditional Nigerian society as traditionally and culturally sacred, and the dwelling places of the gods and spirits.

products transported through these pipelines (Adenikinju and Falobi, 2006; Omeje, 2006c).

The plethora of externalities which the pipelines have generated over time in Enugu also finds expression in the long distances the law-abiding Enugu people now travel in order to reach the designated crossing points on the ROW, most of which are located far away from the communities. About 20% of the respondents contended that they now travel longer distances than they used to before the pipelines were built. This, according to them, has further escalated the heavy burden of subsistence caused by the global economic recession in 2009.

As Onuoha (2007) stated:

> *[...] a country where 85 per cent of oil revenues accrue to 1 per cent of a population of 140 million people; where perhaps US$100 billion of US$400 billion in oil revenues since 1970 have been misappropriated; where between 1965 and 2004 the per capita income fell from US$250 to US$212 and income distribution deteriorated markedly over the same period; and where between 1970 and 2000, the number of people subsisting on less than one dollar per day grew from 36 per cent to more than 70 per cent: from 19 million to a staggering 90 million, widespread poverty, discontent or failed expectations must have explanatory relevance in the upsurge of pipeline vandalism* (Onuha, 2007: 10)

The assertions above were found to characterise the yearnings of the Enugu people, over 67% of whom held that the ROW had not been of any marked benefit to the communities. Rather, an overwhelming 95% of the respondents cited soil and water contamination to be one of the serious consequences that the pipelines had brought to the communities within the conurbation of Enugu as instances of vandalism. The pipelines, they said, have so far been very unrewarding to the people.

From the forgoing analyses it has become evident that the critical question is how the pipeline, which ought to be the symbol of oil wealth, has become the reason for the poverty in the lands it traverses in Enugu. It may be that poverty is implicated in pipeline vandalism, or that we need to understand or characterise the place of

poverty in the incidence of pipeline vandalism, because this vandalism usually results in outbreaks of fire. This study has shown that the operation of the pipelines in Enugu, as in the other parts of Nigeria it traverses, has not been framed to deal with the contending interests of the different stakeholders that operate covertly or overtly, lawfully or unlawfully, on the ROW. As a result, therefore, there is a need for an infrastructural framework that would harness the opposing triple forces (governmental authority, communities' perceived right to rent from the lands usurped by the pipelines, and criminality), and this framework should operate on behalf of the different interests, and from different concepts of legitimacy; it is the conspicuous lack of such a framework which has created the operating void in which vandalism thrives.

7.8.6 Communities and the management of the ROW

Collaboration aimed at the management of public infrastructures, such as the pipelines in communities, has the potential to ensure that the interests of both public authorities and communities are integrated to achieve mutually reinforcing management and maintenance of the pipeline infrastructure that is publicly owned but located within local communities. The communities in the Enugu conurbation have indicated their interest in taking an active role in the management of the petroleum pipelines that traverse community lands, as it is the community which suffers most in the event of vandalism. All of this presupposes that the members will adapt to the task of managing the pipelines if they have the leverage to engage. They will be necessarily constrained to act in good faith, so that the huge losses that vandalism portends for them in terms of loss of life, property and environmental degradation are completely obliterated or at least reduced to a minimum.
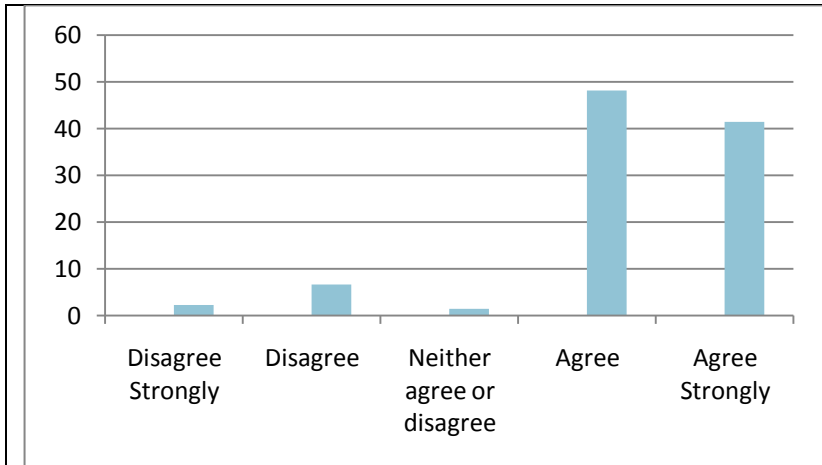
Figure 41: Participation in ROW management in Enugu

Source: Fieldwork 2009

As seen in Figure 41, the respondents in Enugu are keen to have a role in the management of the ROW of the petroleum pipelines that traverse their communities. About 90% agreed that the community should be involved in any effort at managing the pipelines and that the communities should also be compensated for the consequences of damage caused by vandalism in terms of property losses, and so they would work hard to remove threats of vandalism before they become manifest.

7.9 Oil and pipeline politics: Evidence from Port Harcourt

Port Harcourt is the Headquarters of Rivers State in the Niger Delta Region of Nigeria. The state was created on May 27 1967 and lies within latitude 4^0 20' S and $5^0$50' N and longitude $6^0$20' and $7^0$35'E. It shares land and marine boundaries with Bayelsa State and Delta State to the west, Imo State and Abia State to the North, Akwa Ibom State to the east and the Atlantic Ocean to the south.

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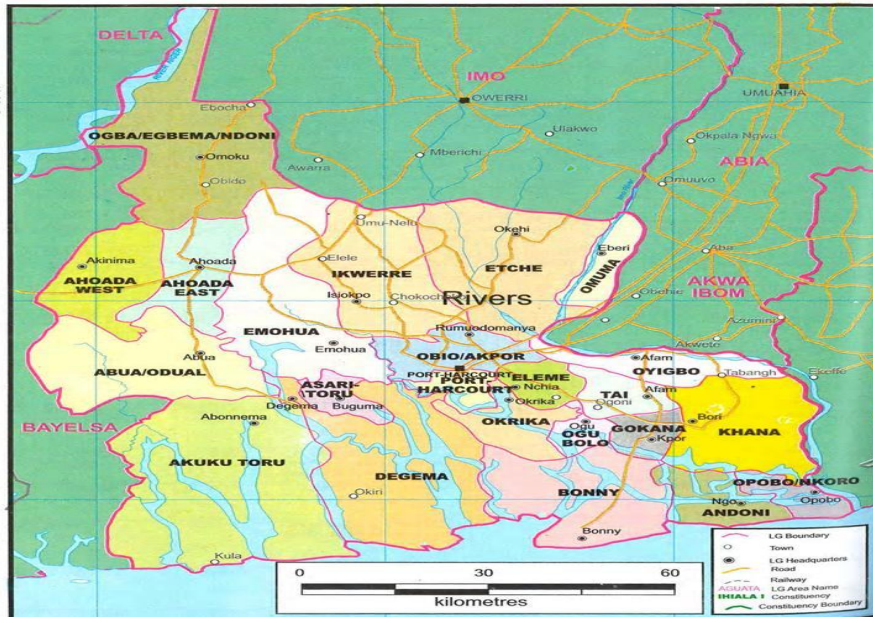
Figure 42: Map of Rivers State

Source: Independent National Electoral Commission of Nigeria 2008

According to the National Census of 2006, the population of Port Harcourt is 541,115 persons and that of Rivers State is 1,824,407 persons. Port Harcourt, the case study in the Niger Delta Region, is not only the most prominent and populous city and Local Government Area in Rivers State, it is also the most prominent city in the entire Niger Delta region of the country, from where most of the oil and gas prospecting, exploration, refining and transportation both for local consumption and internationally for export are controlled. Its position in the river delta is clear from Figure 42. Port Harcourt is the only city in the country with two refineries; while the greater Port Harcourt conurbation is the host of numerous oil and non-oil companies. Rivers State is one of the largest producers of oil and natural gas in Nigeria. Other mineral resources produced in the state include silica sand, glass and clay. Port Harcourt, Rivers State and the entire Niger Delta region have recorded more incidents of pipeline vandalism and associated explosions than all other regions of Nigeria (Jesuleye et al., 2007).

7.9.1 Problems of pipeline vandalism in the Niger delta region

The first large scale vandalism of petroleum pipelines in the Niger Delta region of Nigeria took place in 1998 (Onuoha, 2008b). The incident occurred in Jesse town in the Ethiope East Local Government area of Delta State. Since the Jesse disaster, oil fire disasters owing to pipeline vandalism have become a recurrent source of huge losses in terms of property, human life and near irreparable damage to the environment (Ghazvinian, 2007). The past decade (1999-2009) has witnessed increasing incidence of vandalism with associated explosions that similarly pose serious threats to human life, property and the environment.

Figure 43: Fire caused by pipeline vandalism in Port Harcourt

Source: Field Work 2009

As illustrated in Figure 43, fires caused by vandalism have affected the environment, and by extension the people, in Port Harcourt and the larger Niger Delta region. The more vulnerable groups, such as women and children, have given into the temptation of tapping from the spoils of vandalism, which has often resulted in disaster. One interviewee said that:

> *[...]vulnerable women, children and the poor in Rivers State have suffered owing to oil disasters, which are mediated through the complex processes of oil company activities, involving economic, social and political factors that expose our people to risks, as well as greatly influencing their perception of*

the interpretation of risk situations. The oil produced in the Niger Delta has not improved the lot of the people; on the contrary, the people are faced with new kinds of problems on a daily basis because of the activities of the Nigerian National Oil Company and other Multinational Oil Companies that operate in the area. .

Regardless of how this description of the oil companies' activities can be interpreted, the people felt that they had not benefited enough from the oil and gas industry in the Niger Delta. They also felt that the problem of vandalism had affected the social fabric of their society and that this had tilted the people's perception of risks. In addition to this, an analysis of the case study data from Port Harcourt, detailing the scale and manifestations of the problems of pipeline vandalism in Port Harcourt, and other problems associated therewith, is presented below.

7.9.2 Pipeline awareness in Port Harcourt

Damage done to their environment has translated into a direct loss of resources, such as fish and other natural environmental derivatives, which the people harvested from the lush mangrove swamp environment in Port Harcourt (Luiselli and Akani, 2002). The level of awareness about the pipelines in Port Harcourt was very high, as shown by the responses of the respondents. This research found that the issue of petroleum pipelines was not only well known in Port Harcourt, but was also one about which the people held a variety of views, as will be detailed in the course of this analysis.
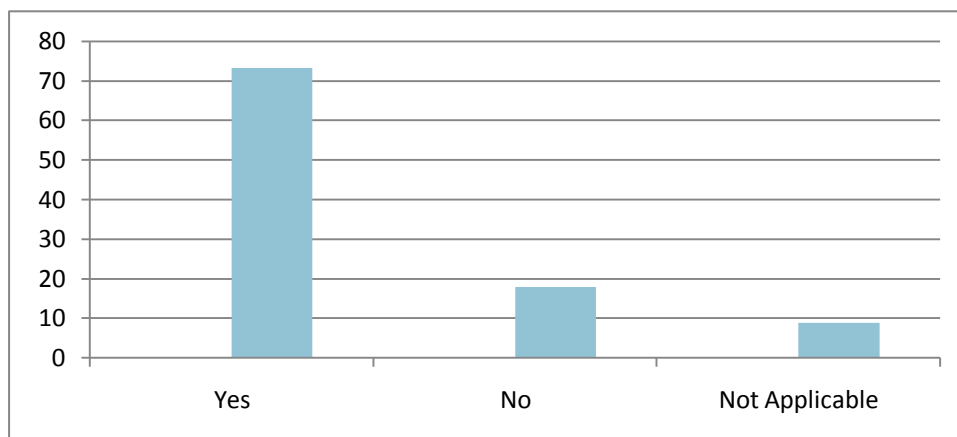
Figure 44: Awareness about pipeline existence in Port Harcourt

Source: Fieldwork 2009

As shown in Figure 44, over 73% of the respondents answered yes to the question about awareness of the pipelines in their communities. As Ogri (2001) puts it, oil spillage and its consequent environmental problems have become features of petroleum exploration in Nigeria, especially in the Niger Delta and particularly in Port Harcourt, where seven in every ten respondents knew about the pipelines. Similarly, six in every ten respondents in Port Harcourt were aware of national laws protecting the pipelines. In spite of the high level of awareness of the existence of the pipelines, three in ten of the respondents still had their dwelling houses built on the ROW. This research also revealed that many people in Port Harcourt still cross the ROW at undesignated points in the course of their daily activities. Over 47% of the respondents still cross the ROW daily in pursuit of livelihoods, disregarding the fact that it is against the law.

7.93 Oil exploration and development

The Niger Delta is one of the largest wetlands in the world and has unique environmental and physical characteristics that make physical development difficult. This research described how the Niger Delta region is composed of many ridge barriers of beach sand, that are backed by brackish swamp mangrove with soft compressible soils that are costly to develop. Further investigation in the communities in this case study revealed that agricultural production has greatly reduced and other non-formal means of production in the area have also declined in recent years, with implications for the regions' local economy. Production in the non oil sector has been far below the potential of the land because of vandalism and oil spillage. As a result, food that used to be grown in the region is now imported.

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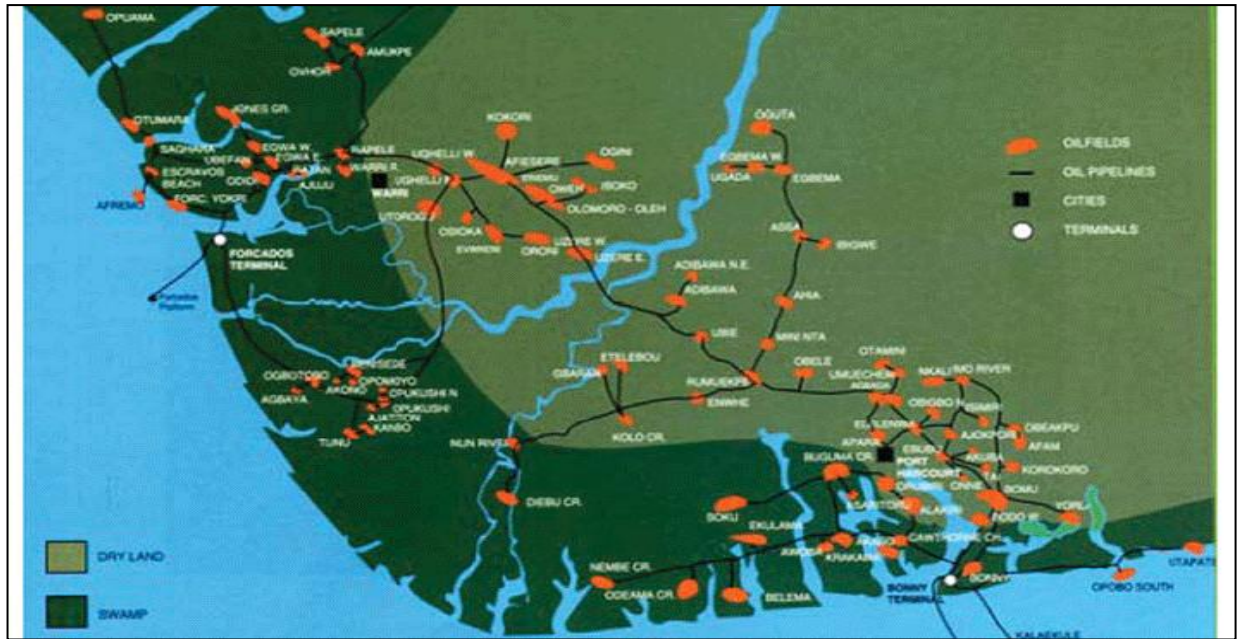
Figure 45: Proliferation of rivers and lagoons of the Niger Delta

Source: Urhobo Historical Society, 2007

Despite the proliferation of rivers and lagoons shown in figure 45 is synonymous with the region's name (Niger Delta). Investigation from the communities in the case study indicates that fish production was reported by the people of the area to be very poor owing to incessant oil spillage, thereby requiring major importation for local consumption. Industrial and manufacturing activities were also seen to be similarly poor, with oil related activities dominating the scene and very little diversification to non oil operations.

According to Eaton (1997), the rich solid minerals in the region, apart from oil and gas, had not been exploited because investing in oil and gas prospecting is believed to pay higher returns, both to the investing multinationals and to the rent-seeking authorities in the host communities. The level of development of non-oil sector production activities is at its lowest ebb in Port Harcourt because the people are constantly engaged in either protesting environmental degradation from the activities of the oil companies or contending with explosions resulting from pipeline vandalism. The environment, which otherwise is blessed with alluvial soils and ample water, has been made vile and unsuitable for production using the agrarian technology of the people (Goldman and A. Schurman, 2000).

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7.9.4 Communalities and ROW management in Port Harcourt

Even though over 80% of national income in Nigeria is derived from oil and gas resources produced from the Niger Delta region (Aigbokhan, 2000), this research has revealed that the rate of unemployment is high, especially among the young. Many of the youths interviewed said that they had eagerly searched for gainful employment but been unable to find work. The ROW of the pipeline provided one avenue that can be used to provide employment for these youths.
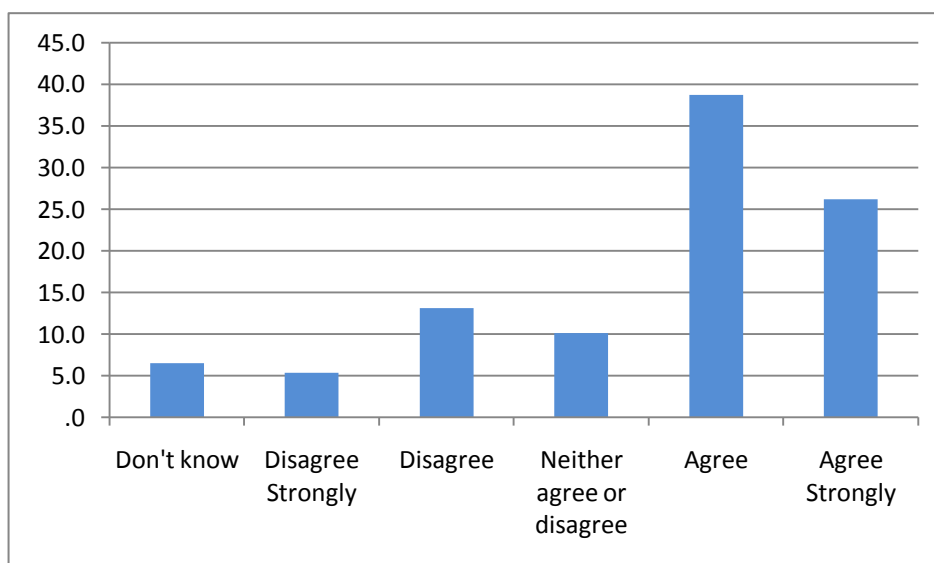
Figure 46: Niger Delta Community's participation in ROW management

Source: Fieldwork 2009

The majority of the respondents in the Niger Delta said that involvement of community members in the ROW management has the potential of giving the unemployed youths the opportunity of securing gainful employment by way of participating in the management of the area's pipeline network. As seen in Figure 46, about 38% of the respondents agreed that community members should be involved in the management of the ROW. Another 26% of respondents strongly agreed that community members should be considered as stakeholders in the management. In all, over 70% of the respondents either agreed or strongly agreed that community members' involvement in the management of the ROW was important. This shows that any initiative aimed at providing an avenue whereby unemployed youths in the

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community and by extension, the community as a whole, will be involved in the management of the ROW that traverse many of the communities in the Niger Delta is sure to receive the overwhelming support and participation of the people. With the involvement of the people in the management of the ROW, they will feel morally and legally empowered to take measures that will frustrate the activities of the baron vandals, who not only recruit vulnerable unemployed youths but also visit the communities at will to fraternise with the people.

In the absence of gainful employment, even children of school age are active in contributing to the income of their families. Furthermore, investigations in the communities show that the children in the ROW communities in this case study drop out of school because of the negative consequences pipeline vandalism on the economic situation of their families. The implications of children in the Niger delta Region growing up into uneducated youths have been reported by Onuoha (2008) to have two implications for the society. It breeds youths who can be easily manipulated by the baron vandals into criminal activities like pipeline vandalism and the youth restiveness in the region in the last decade is a manifestation of the frustration of the an age group of youths in the area who have lost out in the employment opportunities in the region because they are uneducated.

Figure 47: Children harvesting sand from a contaminated river in Port Harcourt

Source: Fieldwork, 2009.

As shown in figure 47, sand harvesting from contaminated rivers has become a source of employment for people, and is mainly done through the use of canoes that are manually paddled in contaminated rivers, in spite of the knowledge that many have been attacked by predator aquatic creatures in the past. This labour-intensive primary employment is mainly engaged in by school age children. As seen in Figure 48, children of school age engage in the high risk behaviour of harvesting sand from tributaries of the Atlantic Ocean. This has exposed them to a number of hazards which range from infection from the contaminated water, harm from predatory aquatic animals such as crocodiles and the prospect of becoming involved in anti-social behaviour and vandalism.

Similarly, many communities in Port Harcourt have experienced vandalism, about 36% of which was said to have been caused either solely by people within the communities or by community members acting in collaboration with people from outside the community. About 32% of the sample in Port Harcourt had lost loved ones owing to pipeline vandalism and another 33% had lost property to infernos caused by pipeline vandalism. Losses to the communities owing to vandalism and other oil exploration-related problems have become a recurrent event in the Niger Delta. An interviewee who expressed sadness that the oil in the Niger Delta has made many of the communities suffer losses said that:

> *[...] the incessant loss of life and property in Port Harcourt is at the centre of the near unanimous community-wide consensus among the people and civil society groups' actions against the authorities and the exploring oil companies, comprising national oil companies, multinational oil companies and other contracting service companies operating in the area (Youth leader in Port Harcourt, 03/05/2009).*

Interpreting this description of the problems that the oil industry has caused in the Niger Delta area implies at the very least that there is a breakdown in communication between the oil companies and their host communities. Drawing from this explanation, it becomes clear why many of the youths in the area are increasingly becoming involved in vandalism and other restive criminal activities that have made the area so volatile in the past two decades. This research discovered that in addition to the revenue losses from vandalism to the country and the oil companies, the

problems have also affected the people and their agrarian way of life. Cases of violent crime have escalated since the youths in the area took their protests by vandalism to the creeks.

Criminal elements in society have also taken advantage of the situation to infiltrate the ranks of the protesting uneducated youths, engaging them as accessories for the theft of oil and gas products from vandalised pipelines in the creeks and other parts of the region. This research has revealed that some of the people who have infiltrated the youths' social groups for the sole purpose of using them for theft of oil products from the pipelines are non Nigerians. One key informant said:

> *[...] six Ghanaians were arrested siphoning crude oil from a pipeline in the Creeks by the Nigerian Navy and because the alleged infraction borders on economic crimes, they were handed over to us for further investigation and prosecution. Upon further investigation, we discovered that they had Nigerian collaborators and that they had been successfully doing the illegal business for years. They possessed fake Nigerian national passports. They were each convicted along with their Nigerian accomplices and sentenced to about sixty years in prison individually* (Operative of Anti-Corruption Unit 04/05/2009).

Drawing from the above explanation, the problem of vandalism and oil theft has gained international patronage. The successful prosecution of six Ghanaians shows that the failure of governance around the network of pipelines and its associated ROW in Nigeria has attracted the interest of cross-border criminals from within the West African region. Also, criminal elements from outside Africa have been attracted to the vandalism and oil theft activities in the Niger Delta region. One interviewee rationalised this as:

> *[...]a bizarre case involving some nationals of the Philippines. They came all the way from their country to break pipelines in Nigeria. They were caught and successfully prosecuted by the Economic and Financial Crimes Commission and confessed to having been doing the illegal business with some Nigerian collaborators for over 10 years. The situation with the pipeline in Nigeria is bad and nobody seems to be in charge of the pipelines.*

Community members in the Niger Delta have also been arrested and prosecuted by our agency for direct involvement and for acting as accessories for nationals of other countries. (Prosecuting Counsel, Anti-Corruption Unit 05/05/2009).

The problem of vandalism and oil theft which started in the Niger Delta region has spread across Nigeria and attracts criminal elements not only from Africa but also from countries that are as far away from Nigeria as the Philippines. The number of vandalism incidents has increased since the reported involvement of criminals from other countries. The people in their communities have also been intimidated by combined teams of foreign invaders and their Nigerian accomplices. Similarly, the amount of oil spillage and its associated damage to the environment has increased and more fish ponds and farmlands have been contaminated. A fish farmer summed-up his experience of vandalism and the oil spill it has caused in Niger Delta communities as:

[...] the negative externalities of the now frequent cases of vandalism put the communities and their livelihoods at risk. In events where the vandals invade the communities, the people are put through moments of ravaging psychological trauma. The impact on the people is aggravated when oil spillage results. The environment, especially the mangrove forest and the swampy soil that characterise the area, is expensive and difficult to remediate when damaged by spills of either refined or crude petroleum products (A fish farmer in Port Harcourt 05/05/2009).

More farmers and others engaged in agrarian activities in the Niger Delta are losing their means of livelihood to vandalism and oil spillage and are becoming desperate to find a means of daily subsistence. Vandal barons have exploited the situation to increase the number of people they can call up at short notice to use as accessories to vandalism and oil theft, with their cumulative negative effects on the environment and revenue generation for the country and the oil companies that pump products through the pipelines.

Figure 48: A farmer pointing to his oil-spill polluted fish pond in Port Harcourt

Source: Urhobo Historical Society, 2009

As illustrated in Figure 48, communities face levels of environmental pollution that are beyond their coping abilities. Some of them have lost the fish ponds and farmlands passed on to them by their forebears. Some of the spill sites that span several kilometres are left to natural processes of remediation alone, because there is no action from the oil companies and the relevant departments of the Nigerian government. This study further reveals that the ROW are replete with spills and environmental damage at varying levels across the country.

7.9.5 The environmental effects

Unlike the situation in the other case studies, where the percentage of the people in receipt of compensation was very low, over 32% of the respondents in Port Harcourt had already received compensation. The remaining respondents expressed optimism that the authorities would pay them, in the wake of both the peaceful protest and violent struggle they had so far mounted for a fair share in the proceeds of oil from the Niger Delta region. They said, however, that further oil and gas prospecting activities by the oil companies had meant a progressive expansion of the amount of community land that the state acquires compulsorily (National Assembly Nigeria, 1990d).
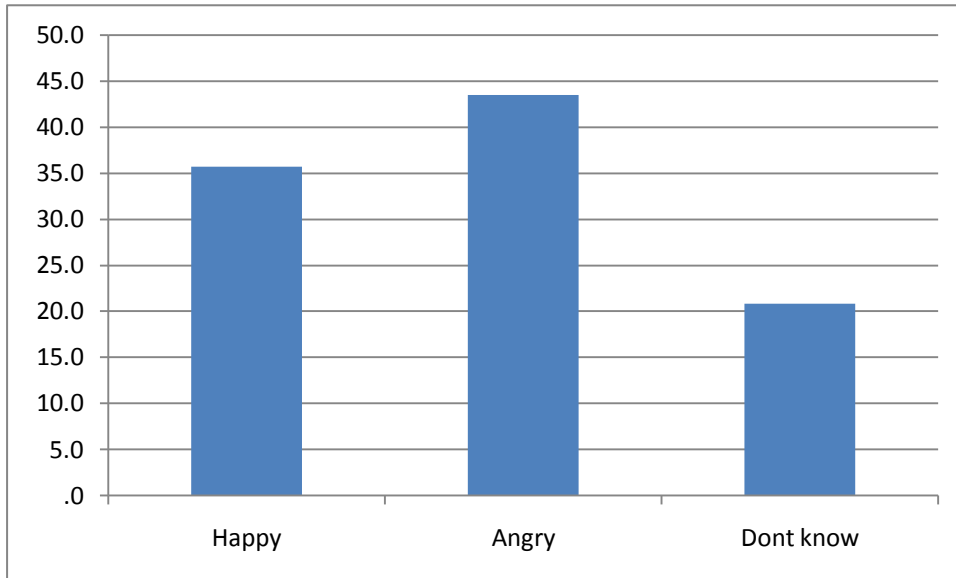
Figure 49: Feelings about pipelines in Port Harcourt

Source: Fieldwork 2009.

As seen in Figure 59, over 43% of the respondents in Port Harcourt were not happy about the ROW of the pipeline which has taken parts of the community land. They claimed that the pipelines had deprived the communities of scarce arable lands and also predisposed them to the negative externalities of vandalism. Oil spills pose a severe threat to the sustainability of biodiversity resources, particularly fisheries, and marine/coastal wildlife.

Figure 50: Gas flaring in a community in Port Harcourt

Source: Urhobo Historical Society, 2009

As shown in Figure 50, supported by oil spillage data for 2000–2008 (Abolurin, 2008; Abraka, 2004), over 270 million barrels of oil have been discharged into the environment, destroying the people's main source of livelihood. As reflected in the responses of the population sampled in Port Harcourt, the people are angry at the government. Over 33% said that the protest against government policies, through pipeline vandalism and other civil disobedience activities has become a necessary means through which they sensitise the government to the plight of the communities. According to them, the vandalism and civil disobedience approach has worked, because the authorities have ceded 10% equity in oil exploration activities to host communities in the Niger Delta region of Nigeria.

Communities that hitherto existed as a single nucleated settlement have now been separated by the pipelines in Port Harcourt. The growing expansion of pipelines connecting the new oil wells also means that more communities are still susceptible to having pipelines lain across them, ultimately resulting in their separation. This not only separates communities, but also exposes them to the immediate impacts of explosions due to vandalism. About 50% of the respondents submitted that their communities had been separated by the pipelines in Port Harcourt, with another 70% of the respondents asserting that the pipelines had impoverished their communities.

Similarly, for about 70% of the respondents, the agrarian means of livelihood of the Port Harcourt communities, as well as primary production activities, are continuously being destroyed by exploration-related dredging and oil spillages. Furthermore, over 57% of the people agreed that sacred community lands had been and are being desecrated by the expansion activities of the oil companies in Port Harcourt. In addition, over 50% of the respondents perceived that the communities were threatened by the public health hazard created by the pipelines, arising from the exploration and drilling activities of the oil and gas companies in the area.

Figure 51: Mangrove swamp in Port Harcourt

Source: Fagbeja 2008.

As shown in Figure 51, the environment in areas that have not been invaded by the activities of the oil and gas companies still maintains its serene swampy mangrove is alluvial characteristics. This was corroborated by an aggrieved member of a riverside community who lamented that:

> *[...] the surviving mangroves in the creeks are at the mercy of the oil companies which may choose to exercise the option to embark on prospecting programmes that would destroy the aesthetic amenities in these mangroves as they expand their exploration activities (Community leader in Niger Delta 05/05/2009).*

7.9.6 Agitation caused by gas flare

Agitations from aggrieved community members have, according to Odogwu (Odogwu, 1991), resulted in the peace and tranquillity plummeting in these communities, to be replaced by heightened criminal activities. There is water everywhere in these communities but this research found that the people lack potable water to drink because of pollution caused by vandalism, oil spillage and gas flare. Furthermore, over 90% of the respondents lamented that they can scarcely procure potable water although living in a riverside environment.

Figure 52: Gas flaring in Port Harcourt

Source: Fagbeja 2008.

As seen in Figure 52, the communities' atmospheric environments are constantly fed by harmful gases which flare continuously as a result of the operations of the multinational oil companies. These flares create a very high risk of fire outbreaks, which sporadically plague the communities, as over 80% of the respondents confirmed. The community members were unanimous in condemning the ROW, with over 40% of the respondents insisting that they had never been useful to the communities (Ebeku, 2008).

7.10 Cross-case analysis

To provide the background for a theoretical discussion of the findings in chapter eight with regard to the research aim and objectives, this section explains the spatial vagaries of the problem of pipeline vandalism across Nigeria.

Table 14: Closeness of community households to the petroleum pipeline

Location (%)	>50m	≤ 50m	Don't know
Abuja (n=132)	56.1	25.9	18.0
Benue state (n=144)	41.1	31.5	27.4
Enugu State(n=125)	39.3	31.9	28.7
Rivers State (n=131)	31.0	43.5	34.6
Total (n=588)	41.3	31.1	27.6

Source: Fieldwork 2009

As seen in Table 14, 56.1% of the respondents who encroached upon the ROW in Abuja live within less 50m of the pipeline, a situation that puts them at the greatest risk of disaster in the event of pipeline vandalism. Rivers State had the lowest percentage (31%) of all the case studies regarding encroachments. Rivers State serves as the headquarters of the oil and gas industry in Nigeria and also has the highest concentration of oil pipelines but, because of higher awareness of the serious hazards of locating close to the pipeline, more households have moved away from the pipeline to safer locations.

Furthermore, vandalism has made it difficult for the national oil company to pump petroleum products via pipelines to its 22 depots across the country. The amount lost to vandalism includes costs incurred from product losses and money spent on repairs. The problem has jeopardised the combined working capacity of all four refineries, as well as failing to meet the holding capacities of the 22 storage depots nationwide, which are supposed to provide product sufficiency of up to 32 days for petrol, 65 days for kerosene and 42 days for diesel. The net effect of this is the undesirable experience of petroleum product scarcity across the country.

The activities of pipeline vandals have made it impossible for the pipelines and other ancillary distribution facilities to function optimally in the past decade in the country. This study reveals that the incidence of pipeline vandalism has been steadily increasing since it became a national problem in the mid 1990s. In 1995, seven cases of vandalism were reported. In 1996 it was 33. The figure rose to 34 and 57 in 1997 and 1998 respectively. However, since 1999, the statistics on oil pipeline vandalism have reached staggering proportions. In 1999, 497 cases were reported and in the decade from 2000 to 2010, over 16,000 cases have been reported.

Although the northern region is larger in terms of landmass and population, the intensity of vandalism in terms of frequency of incidents, and the scale of the consequent socio-economic and environmental fall-out, as shown above was higher in the southern region. Because of the high prevalence of vandalism, many of the major inland petroleum product distribution depots, which used to be hives of activity, are now deserted. As a result, many of those employed there have lost their jobs. Widespread oil spills caused by vandalism have also damaged much farmland and contaminated water bodies hitherto used for fishing. The pipelines have attracted

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external criminal groups to many of the communities, a situation responsible for the sporadic violent criminal clashes the communities have witnessed. Statistically, the national spread of incidences of vandalism has varied over the past decade.

7.10.1 National spread of the problem of vandalism

Statistics show that a total of 16,083 pipeline breaks were recorded within a decade. Out of this figure, 398 pipeline breaks, representing 2.4%, were due to ageing and ruptures, while the activities of vandals accounted for 15,685 breaks, which equates to about 97.5% of the total number of cases. The System 2E and 2EX pipeline systems, which convey products from the Port Harcourt refinery to the Aba-Enugu-Makurdi depots onwards to Yola-Enugu-Auchi, have the highest incidence of vandalism, particularly the Port Harcourt-Aba/Isiala-Ngwa axis. Available data show that 8,105 breaks occurred along System 2E within the period, representing 50.3% of the total number of petroleum pipeline vandalism incidents in the country in the past decade. This resulted in a monetary loss that has been quantified at $0.78 billion in terms of product losses and pipeline repairs (Ejiofor and Ezigbo, 2010).

The System 2A product pipeline route, which conveys products from Warri through Benin to Suleja and Ore depots, ranks second on the scale of pipeline vandalism, with a total of 3,259 cases, representing about 20.2% of the total number of petroleum products pipeline breaks in Nigeria from 2000 to April 2010. I found a loss of over $0.23 billion in products and pipeline repairs on this segment of the pipeline network. System 2B carries products from the Atlas Cove through Mosimi to the Satellite fuel distribution depot, in addition to the Ibadan and Ilorin depots, and recorded 2,440 cases of vandalism in the last decade, leading to a national loss of over $0.76 billion in products and pipeline repairs.

Further analysis of the figures on vandalism reveals increasingly frequent breakdown through vandalism on different segments of the pipeline networks in Nigeria. The Port Harcourt axis of the pipeline, which recorded about 600 cases of vandalism in 2003, recorded 1,650 cases from January to September 2006 alone, while the Warri segment recorded a 600% increase in cases of vandalism, rising from 100 line breaks to 600 during the same period. Likewise, the Mosimi segment, which recorded only 50 cases in 2003, reported about 375 between January and September 2006.

Evidence also shows a national spread in the problem of vandalism. Several cases of vandalism have been recorded on the Kaduna and Gombe segment, where cases of vandalism were hitherto rare. Closely related to the increasing incidence of vandalism as revealed by this study is the associated incidence of explosions and fire disasters that have put the lives of many people in serious jeopardy, including the lives of those living around the routes of these pipelines (Clement-Ogbuanu, 2008; Chika-Amanze and Edomaruse, 2007)

The research also revealed that the problem of pipeline vandalism is not peculiar to oil pipelines. Gas pipelines have also been vandalised in search of gas condensate. Incessant attacks on the Trans Forcados gas pipeline have rendered it non-functional since May 2009, thus making it impossible to evacuate crude oil and gas condensate from some Shell-operated facilities. Evidence from the field also shows that from 2009 to April 2010 production of over 300,000 Barrels Per Day (bpd) was deferred and over 55 vandalised points on this multiproduct pipeline were repaired, at a cost of $0.11 billion.

Further evidence shows that in 2009, the national oil company spent another $42.952 million to execute a two-phase repair project, which started in September 2009, on 74 damaged points in System 2C-1, Escravos–Warri Crude Oil Pipelines, to enable the re-start of the Warri and Kaduna refineries, both rendered redundant for over two years as a result of lack of crude oil supply resulting from pipeline vandalism. The research shows that crude oil was introduced into the Warri-Kaduna segment of the pipeline network on 9 February 2010 and, barely three months on in May of the same year, 47 cases of vandalism for crude theft occurred on this segment, resulting in condensate[24] loss and repairs at an additional cost of $0.16 billion.

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[24] Condensate is also transported via crude oil pipeline in Nigeria.

Table 15: Daily crossing of the pipeline ROW

Percentage (%)	Yes	No
Abuja (n=132)	65.4	34.5
Benue state (n=144)	42.1	58.9
Enugu (n=125)	58.5	41.5
Rivers State (n=131)	69.0	31.0
Total (n=588)	58.8	41.2

Source: Fieldwork 2009

As seen in 15, petroleum pipelines have introduced barriers on the movement of the people in the course of daily subsistence in the communities traversed by it. In Benue, Enugu and Rivers states, 39.7%, 51.1% and 47% respectively of the respondents cross the pipelines as a matter of choice because they feel that the artificial barrier imposed by the pipeline is not justifiable. In Abuja, in spite of the presence of the machinery of the central government of Nigeria, the percentage is 60.4%.

Table 16: Community members should protect pipelines in their community

Location (%)	Disagree	Neither agree nor disagree	Agree
Abuja (n=132)	11.0	19.4	69.1
Benue state (n=144)	13.6	1.4	84.9
Enugu State(n=125)	8.9	1.5	89.6
Rivers State (n=131)	18.5	16.6	64.9
Total (n=588)	13.4	10.1	76.6

Source: Fieldwork 2009

As shown in Table 16, across the case studies, the people expressed their readiness to engage in the management of the ROW. In Abuja, over 69% of the respondents agreed that their community members should be involved in the management of the pipeline. In Benue state, over 80% of the respondents want their community members to play a role in the management of the ROW. The willingness on the part of the people in the ROW communities to engage in efforts aimed at managing has good implications for the collaboration-based management framework contemplated in this study.

7.11 Chapter summary

This chapter has brought together the concerns of this study by applying concepts to the selected petroleum pipeline ROW case studies in Nigeria. For each case study, both primary and secondary data were analysed under the four of the central themes of the research. These are the character and extent of encroachment as encapsulated in the second and third objectives of the research, the issue of impedance to interaction among communities separated by the ROW as enunciated in fourth and fifth objectives, host-community-based socio-economic and environmental problems associated with the management of the pipelines in Nigeria captured in the sixth research objective. Drawing from the synthesis of the findings from the four case studies, the following key findings have been summarised.

7.11.1 Loss of geographic positional knowledge

As shown in sections 7.5.9, 7.6.3 and 7.8.3, knowledge about the geographical position of the pipelines and their associated ROW has been lost in many parts of the country. As a result, various land uses have encroached onto the ROW even though the law prohibits this. Furthermore, it has become impossible to enforce the law for the management of the ROW because the law enforcement agents only oversee the ROW if reports of pipeline failure are received and in most cases they need to be led to the scene by members of the affected communities. Because the ROW is not managed, vandals have seized the opportunity to mount a campaign of vandalism and theft of the products that are transported through the pipelines, damaging the environment and robbing the government's Treasury of revenues, in terms of both loss of products and costs of repairs.

7.11.2 Impedance to free movement

Analysis of data in sections 7.8.4, and 7.9.1 of this chapter has revealed the issue of impedance to interactions among members of the same communities that are now separated by the pipeline project. From the perspective of the law prohibiting unauthorised activities on the ROW, infringements regularly take place when community members across the pipelines at point other than those designated by law. This they have done because of the extra burden that the long walk to the designated crossing points imposes on personal resources that are already stretched.

Over 78% of the respondents crossed the ROW as often as their activities for subsistence required, even though they knew that it was illegal to do so. They hinged their actions on the belief that the ROW does not represent a beneficial land use to them.

7.11.3 Willingness of the people to participate

The data analysed in chapters six and seven have shown that people are willing to embrace a management programme for the ROW that so recognise them as a stakeholder. Furthermore, the oil companies and the government have also demonstrated their willingness to collaborate in an effort to manage the ROW. In sections 7.5.10, 7.6.6 and 7.9.4, the people across the case studies as well as the government and the oil companies in sections 7.5.9 and 7.8.2 have all stated that the current arrangements for the management of the ROW have only helped to promote mistrust amongst the stakeholders in the pipeline project. This shows a degree of unanimity amongst the stakeholders in holding that the current arrangement, which is top-down in structure, with the government and the oil companies determining how the ROW should be managed, has in fact meant that the ROW is devoid of legitimate processes of governance . The people in all the case studies have indicated their willingness to be part of any arrangement for the management of the ROW. Their professed willingness is also a way of assuring the people of their fiduciary responsibility as custodians of environmental justice for the people in the pipeline communities. The people in the pipeline communities have endured greater suffering from the environmental challenges that always result from incidences of pipeline vandalism owing to the ineffectiveness of the present framework.

7.11.4 Government, oil companies and a new approach

The government and the oil companies have indicated their willingness to be part of a management framework for the ROW so that the issues of vandalism and the economic losses in revenues and costs of repairs are curtailed. Particularly in sections 7.5.9 and 7.8.2, they expressed their interest in a framework that would operate to eliminate vandalism and the associated environmental problems. They also acknowledged the linkage between the problems with the inherent failures in their fiduciary duties to the communities along the pipelines that have in the past

decades suffered losses in terms of environmental damages and properties through no fault of their own. Furthermore, summation of the analysis in chapters six and seven shows a failure of governance in the use of the existing top-down approach to the management of the ROW, a development which is helping to aggravate the already grave situation of pipeline vandalism, and its environmental and social consequences on the pipeline communities.

7.11.5 The option of collaboration

Lastly, the present framework which excludes the communities and other non-formal stakeholders has not been effective in the national drive to manage the ROW in Nigeria as it has pursued a deliberately discriminatory policy to further impoverish the already secluded and vulnerable people in the ROW communities. The result of the implementation of the Pipeline Act and the Land Use Act in the communities has been that the people have lost their traditional rights to land, which is the basic economic resource in the mostly agrarian ROW societies (National Assembly Nigeria, 1990b; National Assembly Nigeria, 1990d). The affected people are resilient in their hope that the government will one day honour its pledge to pay compensation for the land appropriated from them for the pipeline project over three decades ago. Furthermore, the affected communities of people across the four case studies expressed willingness to accept responsibilities from the government and the multinational oil companies to manage the ROW.

CHAPTER 8

THEORETICAL DISCUSSION OF FINDINGS

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CHAPTER 8

THEORETICAL DISCUSSION OF FINDINGS

8.1 Introduction

Having explored the environmental, social and economic problems caused by the absence of a framework that should provide for a symbiotic, collaboration-based management of the ROW of petroleum pipeline infrastructure in Nigeria, this chapter draws out some research findings and theoretically discusses them as a pointer to the policy implications and recommendations in chapter 9.

The chapter presents a national context of the challenges in the management of the ROW, drawing on the review of literature on corporate social responsibility and the potential implementation challenges of an ideal Habermasian conception collaboration-based a management plan the petroleum pipeline ROW in Nigeria. This highlights the failure of the present arrangement, which is currently a reactionary approach to the ROW problem, evidenced by the growing manifestations of distinct social, economic and environmental problems.

8.2 The argument

Drawing from the analysis in chapter seven, this section contextualises the research findings within the purview of corporate social responsibility and collaborative planning as a background to the concluding chapter.

Building upon the preliminary readings and literature reviewed in chapter two, this study discussed the need for a collaboration-based framework to capture and translate the inherent corporate social duty of the government and oil companies that own and operate the pipeline network to achieve the objectives of environmental sustainability in the ROW communities in Nigeria. The research explored all aspects of sustainability in petroleum infrastructure management, the rationale for stakeholders' collaboration to manage public infrastructure in order to respond to the needs of promoting sustainability in social, economic and environmental terms. The collaboration-based management of the ROW is about harnessing all interests in the pipeline to make consensual efforts at socio-economic and environmental

sustainability in the management of the pipeline so that it can benefit all stakeholders. Drawing on this, this study advanced three theoretical arguments.

The study argues the need for collaboration in the management framework for the ROW, and that this should include all stakeholders having an interest in the network of the pipeline. In this sense, it has contended that the attempt to restrict the participation of any stakeholder in the management framework for the pipelines has biased the present concept of management of the ROW. The second argument made is that corporate social responsibility can find expression in collaborative planning practice to achieve the objectives of sustainable development and that this would operate to mitigate the harsh socio-economic and environmental conditions that underpin the explanation of the attitude of the people in the ROW communities towards the pipelines. The third argument is related to the question of to whom the benefit of Collaboration-Based Management of the ROW of Pipelines should fall, where it contended that the fundamental feature is the recognition of all stakeholders within an inclusive framework that ensures justice for all interests.

The research further contends that a collaboration-based approach to the management of the ROW will foster an environment that encourages the participatory engagement of all stakeholders for fairly creating, maintaining and utilising a collaboration-based framework for managing public infrastructures in a sustainable manner. In order to facilitate the creation of a collaborative framework for public infrastructure management within the purview of social, environmental and economic sustainability that benefits all stakeholders, there is a need to establish appropriate institutional mechanisms and policy frameworks encouraging, facilitating and regulating the activities of the stakeholders within the remit of equity and justice.

8.2.1 The instrumental CSR Approach and ROW management

As explained in section 2.3.2, the instrumental concept theorists believe that the corporate social responsibility essence of the business in the community is the creation of wealth for the society (Garriga and Melé, 2004). It has however been shown that this approach to CSR does not lend itself to the issue of the beneficiaries of the wealth created by the business in the society (Schwartz and Carroll, 2003).

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The approach leaves the concept of appropriation of the economic derivatives from business-host community relations to the bargain power of the parties involved. As shown in the Nigerian ROW context, societal acceptance of the instrumental concept produced the result that the oil companies and the government have always out-played the host communities in the ensuing power relations (Scherer and Palazzo, 2007). This has led to an absence of a stakeholders-based management framework, the result of which is a plethora of the social and environmental problems that now manifest on the ROW in Nigeria.

Because there is no management framework that synchronises the interests of the community, the pipelines do not command the support and collaboration of all stakeholders, especially the embittered community members who believe that the advent of the pipeline in their communities has steadily moved them in the direction of environmental degradation, hardship and, by extension, poverty owing to incessant contamination of their sources of water and the destruction of their agrarian means of livelihood.

This research finds that the high level of petroleum pipeline vandalism across the case studies would be drastically reduced if the people were recognised as stakeholders and grafted into the management framework for the ROW. Analysis of the data from structured interview, focus group interview and the key informants reiterated the need to entrust the people in the communities with duties to conduct both covert and overt operations for the safety of the pipelines, and by extension their communities. In Otukpo, indicators of community frustration at incessant vandalism and its effects on the people suggest that the situation is ready for the development of programmes and frameworks of pipeline management in which the members of the community have openly professed their readiness to participate.

Recognising the community as a stakeholder will give the people the needed locus to take action for warding off invading oil thieves from the pipelines. Community members across the ROW have expressed readiness to participate in the management of the pipeline, claiming that, as people affected by the negative externalities of vandalism, the opportunity to be involved in the management of the ROW is critical to achieving success. They maintained that a new wave of environmental challenges has arisen in their communities because the pipeline, which is also the reason for

incessant violent invasion by non-community members mostly for vandalism and theft of oil, is outside their purview by the operation of law (National Assembly Nigeria, 1990d; National Assembly Nigeria, 1990c).

The account of petroleum pipeline development in Nigeria and the present failed approach that excludes the communities from the management of ROW has shown the need for an alternative approach that ensures that other non-governmental and non-corporate stakeholders are empowered to participate. The research finds that the very harsh capital punishment prescribed by the law means that it could not be successfully implemented in the face of growing poverty and community resistance against the perceived inequity in the operations of the oil companies, which ignore the people's economic aspirations in the distribution of the huge profits they make.

In cases of successful conviction, the law prescribes capital punishment for the inimical activities on the pipelines (National Assembly Nigeria, 1990e), but the widespread cases of vandalism on the pipelines portrays the government's lack of capacity to effect implementation of a strict policing policy over the 7,000km of linear structure This has rendered the law largely impossible to implement and to that extent it has become ineffective in the management of the ROW to stem forms of vandalism in the country which were never envisaged.

Approaching the instrumental concept theory of CSR within the purview of the ideals of corporate constitutionality and the prescription of the political theorists discussed in section 2.3.3 would produce the effect that the oil companies and the government will re-order their instrumentalist approach to CSR to serve development purposes in the ROW communities. This is captured in the explanation of the instrumentalist concept by Marquis *et al.* (2007). They introduced to the long held view of instrumental theorists the notion of business as taking a more active role in corporation social responsibility. While recognising the obligation of business to pursue profit for shareholders, they argue that a business is a social institution with social power that must be used responsibly to promote equity in their fiduciary relationship with host communities.

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8.2.2 Public responsibility approach to ROW governance

As discussed in section 2.3.6, Garriga and Melé (2004) tried to construe public responsibility meaning to the concepts of CSR. In explaining their conception of public responsibility approach of corporate social responsibility, they identified the business as the formal stakeholder. Applying this concept of CSR to the ROW would produce a formal/non-formal classification of the actors on the ROW. Taking this further would mean that the business has a fiduciary responsibility to the host community which is identified as the non-formal stakeholder. Improper management of the fiduciary relationship of the government and businesses with host community as has been the case in the Nigerian ROW communities leads to loss of confidence in the idea that the business could be committed to the developmental aspirations of the their host communities (Wood and Jones, 1993).

This research has shown that the people in the communities traversed by the pipelines share a belief in the feasibility of designing optimal rules, based on a collaborative arrangement among all stakeholders to manage ROW across the country if the government and the oil companies would discharge their CSR obligations to the people in an equitable manner. The people opined that the result of an improper management of the inherent responsibility of the business and the oil companies in the host communities has been the reason why some community members either acting alone or in collaboration with non-community members have opted for vandalism.

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Figure 53: Vandals operating on a pipeline in Nigeria

Source: Source: National Oil Spill Detection and Response Agency 2009

As seen in Figure 53, the study also reveals the contradiction between the material circumstances of the poor victims in the ROW communities, and the sophisticated technology deployed in acts of pipeline vandalism in Nigeria. This also indicates why, in the wake of their destroyed agrarian means of livelihood, the poor in the communities are attracted to scooping fuel for survival even though it has caused them various levels of disaster.

As a result of the problems which improper management of the fiduciary responsibility of the oil companies and the government to the host communities has caused, they is need to rethink the approach in a way that accentuate the developmental essence of CSR in the host communities. As Jamali (2007) argued, an appropriate approach to corporate social responsibility ought to detail a prescription of appropriate guidelines for businesses to align their management activities to relevant public policy frameworks that will enable them to gain moral legitimacy in their host community.

8.2.3 A strategic CSR and community access through the ROW

Drawing from the argument in 2.3.10 on strategic CSR and analysis of data from the case studies, the research argues further that in order to achieve success in pipeline infrastructural management policy implementation for pipelines in Nigeria, it is necessary to empower non-governmental stakeholders represented by the communities to translate their concerns of neglect and apathy into positive actions, by giving them a beneficial role in the management of the ROW that traverse their communities (Fox, 2004; Lantos, 2001).

Emerging from the case study analyses is the strong need for a collaborative renaissance that can appropriate the active participation of the locals in the communities in the processes involved in managing the ROW to restore the damaged environmental capacity, activate a proactive precautionary pipeline disaster management initiative, and provide for a social equity policy in the economic opportunities pertaining to the management of the ROW of pipeline network across Nigeria.

Across the case studies, the people feel that the pipeline network has introduced an artificial barrier which impedes inter-community and, in some cases, intra-community interactions. As a strategic CSR approach, the oil companies and the government could work with the host communities to improve legitimate access across the pipelines because the current restrictions notwithstanding, the people across the case studies still cross the pipelines at undesignated points.

A shown in section 8.2.2, particularly in table 15, the problem of crossing the pipeline because it impedes access for community members resonates across the case studies. The impression of artificial barriers that characterise the thinking of the people with regards to pipelines across the case studies in Abuja, Otukpo, Enugu and Port Harcourt would be defused with support for a multi-stakeholder dialogue to harness the interests of the pipeline communities and then aggregating these with the strategic interests of the state and the oil companies with a view to mutually agreeing on a management framework that accommodates local community interests.

8.3 CSR failure induced Social and economic challenges

After theoretically contextualising the key findings of the research, it is necessary to discuss the unique social and environmental challenges that the failure of CSR has caused in the over five decade operation of the pipelines and the associated ROW in Nigeria.

8.3.1 Pipeline vandalism

The most important of the social and environmental problem caused by failure of governance in relation to the pipelines and its ROW in Nigeria is the growing occurrence of deliberate acts damage to the pipelines. This research has also shown that the term pipeline vandalism used to describe deliberate acts of damage to petroleum pipelines in Nigeria has gained popular usage because of the plethora of destruction of the pipeline and oil theft in Nigeria. The term has developed to mean rendering the pipelines incapable of transporting petroleum products across the network in the country and in the process creating unprecedented environmental and socio-economic consequences. Pipeline vandalism in Nigeria is known to occur both in the hinterland and in marine environment. While all acts of vandalism that take place on land is termed vandalism, the variant of pipeline vandalism that occurs within marine environment is referred to as oil bunkering.

8.3.2 Oil bunkering

The research also identified a specific type of vandalism that occurs in maritime contexts. This is the concept of "oil bunkering" which means the damaging of petroleum pipelines in the creeks and the open sea for the purpose of oil theft, with the use of barges and ocean going vessels. The term bunkering is used to describe the process of filling a ship with oil and gas condensate from damaged pipelines by oil thieves. This criminal act is rampant in the coastal waters along the coastal area of Nigeria.

Figure 54: An oil bunkerer in action

Source: National Oil Spill Detection and Response Agency 2009

As seen in Figure 54, further analysis shows that oil thieves build sophisticated temporary enclosures around a small section of underwater pipe in order to tap into it and siphon off crude oil. After building the temporary enclosures, they leave them suspended above the water. In some cases, however, these are lowered beneath the water's surface in the creeks to conceal them from view. In both cases, the oil thieves improvise temporary taps to siphon oil to water vessels.

8.4 Social and economic effects

This research revealed that the pipelines have not improved the social and economic situation of the people. The social condition of the people has worsened compared with when the pipeline project started. The pipeline has attracted criminality such as vandalism and other violent crimes that were alien to communities before the pipeline project. Only about 5% of the population in the pipeline communities reach their 60th birthday owing at least nearly to poverty and pollution. Furthermore, life expectancy in ROW communities has reduced over the years since the introduction of the pipelines, also because of poverty, as well as the hazardous environmental conditions caused by the activities of the oil industry. Employment statistics show that a majority of the people are either unemployed or are employed in the informal sector with an income of less than a dollar per day.

8.4.1 The network of vandal barons and their recruits

The research also identified two classes of vandals: the vandal barons and the disaffected community vandals, who also work for the barons as recruits. Both of these have operated to make the pumping of petroleum products through the over 7,000km network of the pipeline in Nigeria difficult. The operational field of the vandals is the ROW of petroleum pipelines. The barons implant their vandalism and bunkering activities in the communities and recruit the poor, who are mostly uneducated and unsuspecting youths from the pipeline communities. Findings further show that the syndicate of vandals encountered no difficulties in selling the stolen products in the open as well as the black market, because of the acute shortage of petroleum products that plagues Nigeria perennially.

8.4.2 Land use problem

The research finds that the legitimate use of land outside the land use decree is not encouraged in the pipeline communities. The land use decree stipulates stringent conditions for legitimate access to land and this has deprived the people of legitimate economic use of the land in and around the ROW. Before the land use decree was enacted, land was available to the indigenous people within the pipeline communities, without any prescription of the government, as a valuable resource which could allow them to mobilise their own socio-economic advancement.

The land use decree took this native privilege of access to land away from the communities in Nigeria. The people now, by the operation of the land use decree, have to compete for land ownership with corporate organisations such as the oil companies. Being the weaker party in the new regime of the scramble for land, the people are always the losers and are thus becoming alienated in their native land.

8.4.3 Failed promises of development as CSR failure

Findings across the case studies show that the oil companies were not short of developmental promises to the pipeline communities. These promises, according to reports from the communities, were seldom fulfilled. The offer of false promises was used as a strategy to keep the communities in hope, so that the oil companies could

go about their oil exploration activities undisturbed. People in the communities, which were reminiscent of shanty towns, lack virtually all social amenities.

Furthermore, the people expressed dissatisfaction that the oil companies establish luxurious camps adjacent to their severely deprived settlements. This has created a situation in which the poor residents not only lack all the basic social amenities; they also know that it would be possible for the oil companies to provide these amenities, because in their presence, provision is continually made for the oil camps where the company employees live. As a result of their failed expectations from the pipeline project, many community members have resolved that they will continue to vandalise the pipelines as long as they can find a Vandal Baron to pay them. In one community where there was a high rate of vandalism, an interviewee said:

> *[…] we have resolved that our members will continue to vandalise the pipeline as long as they can find petroleum products flowing through. The act of vandalism has empowered the youths in the community because after damaging the pipeline they scoop up the product to sell on the black market to unsuspecting members of the public and in the process they earn money. The damage which vandalism has to the members of this community in terms of loss of property, human life and the environment has not deterred its vandal members who claim to have been driven by poverty to engage in vandalism as a last resort (community in southern Nigeria, 28/04/2009).*

8.5 Community stakeholders and ROW management

It was observed that, at the heart of the pipeline crisis in Port Harcourt and, indeed, the whole of Nigeria, is the struggle over oil resources. These developments have been further aggravated by the centralist tendencies of the fiscal national revenue and expenditure arrangements upon which Nigeria is built. No substantial trickle down of vast government revenues has occurred and this has caused discontent in the pipeline communities and the Niger Delta region where the bulk of the oil and gas resources that generate the revenues are produced. Nevertheless, the people in the pipeline communities have expressed their willingness to engage in protecting the pipelines as a way of enabling the members of the communities to benefit from the oil wealth in the country.

8.5.1 Towards a collaboration-based approach

This study proposes a collaboration-based framework for managing the ROW. The proposed framework will equitably maintain effective governance and authority within the boundaries of the ROW. In the context of what has been described as a challenge to state power (Frynas, 2005), the state has engaged state agents to implement an essentially violent plan to safe-guard the ROW, arresting and harassing innocent community members in the process. This has not succeeded, because the communities have interpreted it as an attempt to punish them. In a reversal of the intended impact, cases of vandalism have continued to increase across the region.

However, this study reveals that an approach centred on collaboration, whereby the communities will be embraced as stakeholders for the management of the ROW, would succeed as an alternative to the use of force, within the framework of developmental initiatives that address the aspirations of the inhabitants of oil pipeline communities in a sustained and sustainable manner.

The situation in these communities has become persistently dangerous, not only for the pipelines themselves and the communities through which they pass, but also because it is undermining efforts at sustainable development. The government has been stirred up to embark on heavy-handed measures against the communities by deployment of troops and military hardware, not only around oil installations, but throughout the entire region (Obi, 2009). It was observed that the government tends to operate with a policy mindset that perceives every threat to law and order in the region as inextricably linked to an attempt to undermine oil production and state security. With the increased spate of violence, kidnappings, oil bunkering and armed combat, the crisis has created a picture of the region as restive and volatile.

However, the core issue still centres on the urgent need for institution building and the re-entry of the state in policy-making as a means of protecting Nigeria's national interests in a globalising economy. This includes securing the co-operation of the communities and other stakeholders for a vandalism-free management of the pipelines. The currently mooted body of legislation makes no reference to the incessant problem of vandalism. This shows that this prominent and looming crisis

on the ROW has still not been given the attention it deserves in the scheme of things. This mutual mistrust between the government, the oil companies and the communities which the vandal barons have exploited can be ameliorated by articulating a new ROW management and development framework agenda that seeks popular forms of stakeholder participation that address social inequality, injustice and development-based approaches to ROW management in Nigeria.

8.5.2 Community-based social problems

Pipeline vandalism has been shown to affect the social and economic wellbeing of communities in many different ways. The negative externalities of vandalism impinge on human rights and a community's sense of safety; they destroy people's means of livelihood and worsen the already negative situation of internal displacement and the dislocation of family structure caused by the traversing of the communities by the pipelines.

Furthermore, apart from the losses suffered in these communities in terms of lives and permanent physical injuries, pipeline vandalism, with its associated fire disaster, also destroys people's means of livelihood and property. Crude oil and refined petroleum products from leaking pipelines are known to destroy aquatic life, crops and farmlands and pollute water formations and streams. Both at the individual and community level, pipeline vandalism have seriously compromised economic and social activities. Important economic crops such as palm trees, rubber, cocoa, plantain, and coffee are often destroyed during pipeline explosions and fire disasters caused by vandalism. Also, contaminated marine resources such as fish and crayfish, and polluted water, were discovered to have caused serious health problems for human beings in the communities where they were consumed. Thus, by destroying the ecological balance that sustains life within these communities, pipeline vandalism threatens the life-support system that has sustained these people and exacerbates the level of poverty of the people who, through no fault of their own, are located close to the ROW.

The vandalism-induced destruction of properties adds another dimension to the socio-economic problems of the people. For instance, the fire incident which caused the pipeline explosion of 26 December 2006, in the Ebule-Egba community in

Lagos, destroyed about 40 vehicles and a dozen homes, a mosque and two churches. The incident also accounted for the destruction of many small-scale business ventures. The explosion affected the power supply in the area for a period of two weeks. As revealed by this research, in the case of Oviri Court in Delta State, the communities lost over US$500 million worth of property in addition to environmental pollution and the death of more than 300 people.

At the level of families and individuals, pipeline vandalism and its associated disasters have negatively affected the wellbeing of many individuals and families. Through bereavement and internal displacement, pipeline explosions have led to the deep fracturing of family structures. Consequent upon the death of many adults in these disasters, children are left without parents, and husbands without wives or vice versa. The study shows that, amongst the survivors, many have suffered severe burns and damage to internal organs as the result of the inhalation of fumes and poisonous gases, thus increasing the burden upon families who must support members with various degrees of dependency. Investigation in the communities also revealed that for every death or injury caused by pipeline explosion, there are many who must cope with the psychological, physical and economic aftermath.

8.5.3 The research findings and CSR models

The discussion of the research findings in the context of the different models of corporate social responsibility (CSR) above has shown that no single modular prescription of the CSR concept can provide a complete explanation for governance failure on the ROW in Nigeria. A hybrid of the instrumental approach and the corporate constitutionality perspective seem to provide a theoretical variant that fits the operation of the oil companies and the other private sector players in the oil and gas industry in Nigeria. As shown in section 1.3.2, an exemplar of successful working of farm-holder stakeholders to manage the ROW of a transnational pipeline in Canada. Even though framework for the Canadian pipelines ROW management is not construed as a collaborative activity between the pipeline companies and the farm owners, the success this has recorded in ensuring that cases of breakages which in the case of Canada are mostly due to earth movement and material failures are reported before they becomes environmental problems.

On the contrary, the global context of pipeline management challenges explored in section 3.3 has shown that the approaches in China, Azerbaijan and many parts of the world have not been successful because the workings of the authorities and other stakeholders have not been knitted through collaboration-based framework that makes the management of the pipelines the responsibility of both the governmental and non-governmental stakeholders.

A combination of the public responsibility and strategic approaches of the concept fits a CSR prescription for public authorities involved in making public policy that engages the CSR outreaches of the oil and gas companies, with the result that the developmental aspirations of the host communities who bear most of the negative externalities of the oil pipelines can be expressed towards collaboration-based management of the ROW in Nigeria.

8.5.4 The collaborative framework, an essential for the ROW

As discussed in section 2.5, the collaborative planning principle explores consensus-building and mediation as a way of moving beyond interest group conflicts caused by inequity in power relations among different stakeholders (Healey, 1997c). The principle holds the potential for a collaborative discussion of shared concerns about local environmental changes, in a negotiated way that addresses the identified project impacts, including the project's negative environmental externalities and its social and economic impacts on the people (Kovács and Paganelli, 2003; Healey, 1997c).

Applying this collaborative planning concept seems to provide a workable alternative to the raging problems which improper application of the inherent fiduciary duties of oil companies and the government in the form of CSR outreaches have caused in the management of the ROW in Nigeria. This would suggest a succinct solution to the myriads of social, environmental and implementation problems that have operated over time to prove that the rigid government and Oil Company dictated framework has failed. An ideal Habermasian application of the collaborative planning concept as discussed in section 2.5.1 would produce a management plan that is utopian that may not be implementable in the real-world situation that has so far dictated the various failures in the management of the ROW of pipeline in Nigeria (Hillier, 1998; Tewdwr-Jones and Allmendinger, 1998a).

Because of the inherent real-world difficulty that the implementation of a strict Habermasian construction of a collaborative framework would imply for the management of the ROW, it is important to highlight the necessary criticisms of an entirely Habermasian construction of the intended collaboration-based management framework. A critical awareness is necessary of possible obstacles this approach may encounter in translating the fiduciary CSR commitments of the government and the oil companies in a way that activates genuine sustainable development in the host-community.

8.5.5 Avoiding a strict Habermasian prescription

As explained in section 2.5.2, an ideal Habermasian construction of the collaborative planning process has been criticised as contemplating the processes of collaboration in a realm that is not congruent with the realities of the real world situation within which all planning proposals must be implemented (Hillier, 1998; Tewdwr-Jones and Allmendinger, 1998b; Healey, 1996). Hillier and Gunder (2003), in debunking the ideal world prescription of the collaborative turn in planning, emphasised the importance of power relations in planning decision making, a dynamic that Habermas has tended to understate in his communicative action theory.

Beyond the critiques outlined above, it is evident that collaborative planning thought has introduced a new paradigm into planning theory (Innes and Booher, 2003b). The debate and dialoguing stance of this theory is opposed to the statute-based, iron-cast framework that underpins the prevailing approach to the management of the ROW. This offers the hope that the loss of trust that underscores myriads of social and environmental challenges in the ROW could be addressed through the proposed alternative platform of collaboration among the stakeholders.

Described by some as the paradigm of the 1990s (Healey, 1996), the collaborative planning principle proposes a fundamental challenge to the practice of planning and seeks to explain not only where traditional planning thought has gone wrong but also to present a way forward by way of dialogue to resolve vexed planning issues by stakeholders in order to forge a common solution for the benefit all. Following the many critiques of communicative planning action discussed in 2.5.2, broad areas of concern that militate against the option of a collaborative planning approach have

become obvious and must be considered in the formulation of any proposal with a collaborative planning underpinning. The issues include the problematic assumptions in the original Habermasian theoretical construction of communicative action as a separate concept of sociological action that sees approaches to the planning process from the utopian position of the possibility of absolute consensus which is not always the case in the real-world. Although it is useful to acknowledge the benefits of the collaborative explanation of the planning process and the role of values and consensus-building in decision-settings, it is important to retain a reflective approach to the potential implementation inadequacies of a wholly Habermasian construction of the collaborative framework for the management of the ROW.

While appreciating the possible implementation difficulties that may trail any management plan that seeks to translate the CSR outreaches of the government and oil companies to serve sustainable development purposes in the ROW, it can nevertheless be said that these have been adequately remedied to reflect the distinctive political and professional nuances and exigencies that now exist in collaborative planning practice, as entrenched through the works of contemporary collaborative planning theorists (Hillier and Gunder, 2003; Healey, 1997c).

Healey (1997b) developed a collaborative communicative theory in the context of evaluating processes of governance and planning through debate, which varies in theoretical prescription from the stance of Habermas. The former contemplated a communicative process that is devoid of perfect order in the contentious social relations generated in planning processes. Applying this contemporary construction of the collaborative planning approach as a guide to the implementation of the resulting policy recommendations of this research towards a collaboration-based management of the of the ROW of petroleum pipelines in Nigeria will make a work in progress with inbuilt mechanisms for review of the framework to reflect any changes and concerns which implementation may suggest.

8.5.6 Reflections on implementation challenges

A collaboration-based approach to the management of the ROW of petroleum pipelines in Nigeria which seeks to express the corporate social responsibility commitments of oil companies and the government through the principle of

collaborative planning in order to achieve the ideals of sustainable development in host communities is certain to engage some implementation challenges. The potential implementation challenges lying in a strict prescription of the Habermasian construction of the framework are explained in sections 2.5.1, 2.5.2 and 8.10.

However, the exemplars of collaborative management are discussed in sections 1.3.2 to 1.3.4. In these sections, the Canadian example shows collaboration where the involvement of the local of farms traversed by the pipelines is inherent to their management consistent with the instrumental version of the CSR concept applied to the outreach approach of businesses, as discussed in section 2.3.2. From the Canadian example, it can also be said that the oil company gave credence to the status of the farm owners as stakeholders in the management of the ROW, a concept of CSR explained in section 2.3.7. In the Caspian region, the collaboration is a strategic alliance between the state and the oil companies. In this context, the governments use the pipelines as instrument of political influence in a way that is consistent with the strategic and political concepts of CSR discussed in sections 2.3.3 and 2.3.9.

Drawing from the explanations above and the willingness to collaborate in a new resolve towards the management of the ROW evinced by all stakeholders discussed in chapter seven, the collaboration-based management framework contemplated in this research will engender the involvement of stakeholders including the oil companies, the governments and the host community-based stakeholders in a ROW. This research has shown that the ROW management option proposed in this research has the potential of engendering a relationship that might not only bring mutual benefits to the stakeholders but also has the prospect of making a positive impact on ROW environmental management in Nigeria.

8.6 Summary

This chapter has crystallised the issues in the current study by its theoretical underpinnings, the national context, and the socio-economic implications of its findings.

Nationally, vandalism has made it difficult for the national oil company to supply petroleum products through the network of pipelines to its 22 depots across the country. The amount lost to vandalism includes costs incurred from product losses and money spent on repairs. The problem has jeopardised the combined working capacity of all four refineries and the holding capacities of the 22 storage depots nationwide, which have the installed capacities to provide product sufficiency of up to 32 days for petrol, 65 days for kerosene and 42 days for diesel. The net result is a harmful situation of perennial petroleum product scarcity across the country.

Theoretically, the research has propounded the idea that the concept of corporate social responsibility can find expression in collaborative planning practice, with the result that the objectives of sustainable development are furthered. Another major strand of the argument related to the question of to whom the benefits of Collaboration-Based Management of the ROW of Pipelines should fall, and contended that the fundamental feature is the recognition of all stakeholders within an inclusive framework that ensures justice for all interests. The possible implementation challenges of collaborative planning theory and the models of the CSR have also been discussed in this chapter.

CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

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CHAPTER 9

CONCLUSION AND RECOMMENDATIONS

9.1 Introduction

Chapter one set out the motivation for the study and articulated the research aim and objectives. Chapter two and three critically appraised, reflected and theoretically contextualised Collaboration-Based Management of Petroleum Pipeline Management through a critique of the extant literature which led to the identification of the gap in knowledge. Chapter three conceptualised the problems of linear infrastructure management in global context. Chapter four described the research context and presented a historical account of the development of the network of petroleum pipelines in Nigeria.

In order to achieve the research aim and objectives, chapter five discussed the research methodology and the most appropriate methods were selected to guide the research process. Following an outline of the research methodology, chapter six undertook a process that demarcated and re-identified the ROW of petroleum pipelines in Nigeria. Chapter seven analysed and presented findings from the case studies and chapter eight further discussed the salient findings of the research. Chapter eight discussed the findings of the research as a prelude to the concluding chapter.

Drawing upon the exploration above, this chapter provides a conclusion to this research effort. Reflecting on researching the problems using the existing strategy, policy implications of the research are outlined and a collaboration-based management framework proposed for the ROW of petroleum pipeline. Thereafter, the contributions of the research to existing knowledge are discussed in theoretical, methodological and practical ramifications. The limitations observed in the course of the research are also highlighted in this concluding chapter in addition to recommendations for further research.

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9.2 The problem of the existing strategy

This research has shown that the official response to disasters caused by pipeline vandalism has been late, arriving several hours or days after the incident. Land and fish ponds contaminated by oil spills owing to vandalism are left to go through natural processes of remediation. Across the case studies, the official rescue response to pipeline vandalism-related disasters took several hours to reach the site (where it was activated at all), a result of which was the destruction of life and property that an earlier response could have averted. It was also revealed that, in the midst of this urgent need for pipeline disaster rescue operations, officials devoted precious time to accusations of greed on the part of the poor and accused them of belated reporting of leaking or vandalised pipes. Locating pipeline disaster sites is a major problem for rescue operations, because the ROW is not demarcated. The practice of arresting helpless villagers, many of whom were released soon after because they were proved not to be the perpetrators, but were driven by abject poverty to salvage oil from the burst pipes, is another impediment in the present strategy.

Non-payment of compensation to pipeline community members for the land taken away from them over three decades ago for the pipeline project, and the virtual absence of an effective management framework, has also acted to promote the activities of the vandal barons, who have taken advantage of the situation to find recruits from the communities for their illegal vandalism business. One major impact of this weak response is the exacerbation of poverty among the poor and the vulnerable that have been injured, bereaved, forcefully uprooted, or deprived of their means of livelihood by the acts of pipeline vandalism that pervade their communities.

9.3 Towards a new strategy

With oil pipeline disasters occurring at an average frequency of 4.4 incidents per day in the past ten years and a cumulative loss of about $1.4 billion over the same period, there is a need for the authorities to begin to design and implement measures that will not only protect human lives and property, but also cushion the harsh effects of oil pipeline explosions on the environment. This research therefore advocates the adoption of a collaboration-based petroleum pipeline ROW management framework

in Nigeria. This encapsulates a synergic collaboration involving the relevant government agencies at national, state and local government levels, the multinational oil companies, civil society stakeholders and community-based organisations as part of an overall framework that will also provide for poverty reduction in the pipeline host communities. This collaborative management framework would drive prevention and proactive strategies, and forge a common synergy that would run through the system of stakeholders to ensure consistent exchange of information, ideas and learning for a vandalism-free operation of the pipelines in Nigeria.

This will produce an enduring sustainable and proactive management approach that will not only enhance effective utilisation of the unique capabilities of the various stakeholders and ensure that they do not work at variance, but will also empower the poor located near pipelines, hence reducing the vulnerability of citizens to oil pipeline explosions. This will reduce the rate at which ordinary citizens of the country drift below the poverty line (World Bank, 2004; Special Committee on the Review of Petroleum Product Supply and Distribution, 2000.), and raise awareness about safety for the majority of the people who suffer the effects of oil pipeline vandalism and explosion. Having laid bare the complex activities that operate to make the ROW of petroleum pipelines in Nigeria such corridors of disaster, the need therefore arose to articulate a collaborative framework that creates a vandalism-free regime for the ROW in Nigeria. It is pertinent to construct an elaborate collaboration-based petroleum pipeline ROW management instrument that provides for an integrated framework, detailing roles for all stakeholders.

9.4 Towards a collaboration-based framework

This research has shown that a framework for achieving vandalism-free management of the ROW of petroleum pipelines in Nigeria must necessarily be constructed by articulating a collaboration-based management instrument that elicits and sustains the collaboration of all stakeholders, within the remit of sound institutional frameworks. In this regard, a clear-cut co-operation is required between the different levels of authority (local, state, national and international levels), in order to complement each other's activities and to maximise the use of resources, both human and material.

A proactive policy that accommodates all stakeholders in the management framework will ensure effective participation and utilisation of the capabilities and unique advantages of the identified actors, to achieve a robust system aimed at responding to key early warning signs, ensuring effective risk-reduction measures and developing appropriate disaster mitigation and response strategies. While community-based organisations and local governments will provide public awareness and education services, the governments at the state and federal level will provide hospital and accommodation services as well as compensation for victims if vandalism incidents happen. Civil society will undertake first-aid, evacuation and distributive services; the multinational oil companies will provide material support and relief, and the relevant government agencies will provide the organisational, operational and logistic platform for rescue operations in the event that vandalism results in explosions and fire disaster.

These levels of state authority should be complemented by community-based organisations and civil society should have access to experience, resources and police back-up, which can be harnessed to guide all aspects of decision-making towards the management of the pipelines and their associated ROW in Nigeria. However, these different levels of governmental and non-governmental organisations need to redefine and readjust their roles in order to promote effective co-operation; establish adequate communication networks and early warning systems; disseminate existing and new knowledge; help in effective monitoring, mobilise resources; promote research and innovative solutions; provide the necessary legislative and institutional support, and develop education, training and evaluation techniques for a proactive management framework that is capable of updating itself as new challenges on the ROW become evident.

9.5 A role for the community and local council

As revealed above, the communities and local government areas form the immediate hosts of the pipeline. They suffer most in the event of vandalism and explosion and by proximity have critical terrain knowledge of the immediate environment of the pipelines. With this critical knowledge, the community and the local government authorities have a vital role in improving monitoring activities on

the ROW in order to proactively report incidents or movements that constitute threats to the pipelines. The communities and local governments are usually the bodies that begin to deal with issues of vandalism in practical terms before the other stakeholders, both governmental and non-governmental, become aware of the incident. This is because they are on the ground and closest to the people. They are responsible for putting into effect any general policies decided by the central government within their domain and have observer status for the implementation of infrastructure and development projects. The peculiar knowledge they possess is the power that is crucial for turning ROW management policies into action.

Local policies, planning and regulations can be an effective tool in guiding the interaction between the human use system and the natural events system, in promoting bottom-up, grassroots approaches that would not only act to eliminate vandalism but also contribute to pipeline community development. The management action at this level should be facilitated by providing the legislative support in term of regulations and standards that ensure that their actions are legitimate and also facilitate access to resources to fund the additional responsibility vested in them. Furthermore, their roles, organisation, resources and actions should be readjusted for the effective broad-based application to all the issues identified on the ROW. The activities at this level of the ROW management initiative should promote public enlightenment and co-operation.

Community and local authority actions should promote education, public awareness and training at the community level, by focusing on incremental infrastructure upgrading as a means of winning over the confidence of the people and motivating the development of group-oriented activities. These actions should also promote the dissemination of information and knowledge that will change the perception of the populace about the pipelines, which currently they see as a curse rather than a blessing for their communities. This framework should be based on a clear understanding of the peculiar social structure and the culture of the people in particular localities, in order to capitalise on the existing social coping mechanisms, and to enhance community participation and self-confidence in dealing with issues relating to ROW management. This will ensure the conversion of the current critical inertia into resources that go some way to meeting the developmental needs of the

people, which in turn will impact positively on their disposition towards the pipelines. This requires a broadening of the base of decision-making power, by altering the flow of authority through increased public participation so that the concerns of the people are reflected.

Furthermore, local authorities acting in tandem with the communities should: promote co-operation between their departments; reduce bureaucracy in rescue operations; review staffing arrangements and generate employment opportunities in the communities by engaging locals with requisite knowledge about the location of the pipelines and movements around them; improve reporting skills, and evolve simpler and more precise rules for administrative procedures, including designation and supervision of frontline officers, policy implementation and pipeline project accountability. The activities at this level of the collaborative framework should also integrate disaster mitigation measures into the upgrading planning process of settlements that are located along the ROW. This could be achieved by identifying and assessing potential hazards and providing relevant information about the people in the communities and formulating local emergency and preparedness plans, as well as paying special attention to research and documentation on the ROW.

9.6 Achieving collaboration at the regional level

This research has shown that the impact of disasters caused by pipeline vandalism and explosions transcends communities and local government areas. They have serious and immediate implications at a regional level. These implications include draining regional resources for relief and emergency measures and the increased demand for assistance to locate to safer surrounding areas, and disruption of regional socio-economic conditions as a result of loss of arable lands and fish ponds due respectively to contamination and spillage. Maximising efforts to combat the negative externalities of disasters and other socio-economic problems caused by pipeline vandalism and explosion should link local and sub-national levels by establishing channels for co-operation between the different local authorities. Local knowledge and experience, as well as institutional innovations could be shared between and developed by different communities and local authorities. Moreover, the available resources could be mobilised on a regional level according to a

comprehensive resource management plan, so that a pool of resources is created and administered regionally.

Enhancing co-ordination and integration through a sub-national multi-stakeholder approach is beneficial in two ways. Firstly, co-operation ensures the saving of resources and the reduction of duplication of efforts, as well as encouraging collaborative action within sustainable regional development parameters. Second, a sub-national framework could play the important intermediate role needed to interpret national policies and programmes to communities and local authorities and to aggregate and articulate community, local and sub-national issues at national level. This will ensure that grievances and other specific community and local planning scale issues are articulated and transmitted to the national level for action before they degenerate into actions that could compromise the safety of the pipelines and the communities that locate near them.

9.7 Achieving high level national commitment

The Nigerian federal constitution mandates the national authorities with primary responsibility for protecting the citizenry, as well as the built and natural environments, from the destruction caused by natural and man-made disasters like pipeline vandalism and its associated explosions (National Assembly Nigeria, 1999). It has a major constitutional role in providing the right conditions for enhancing the performance of state, local authorities and community-based institutions. One of the most common problems identified across the case studies is that centralisation of executive and police power within the federal systems in operation make it impossible for the decision makers to be close to communities because of spatial and socio-economic distance. Moreover, centralisation of power has a spatial dimension in focusing development and resources in the capital, often at the expense of development in other areas, especially in remote communities, such as those located near the pipelines. Therefore, comprehensive decentralisation of decision-making to sub-national, local and community levels would tend to enhance local initiatives, maximise the use of resources, respond to threats and the real needs of the people, and build appropriate systems for defining responsibilities and accountability in the administrative systems around the ROW.

9.8 Re-identifying the route of the pipeline in Nigeria

As shown in chapter six, re-discovering the route taken by the ROW is essential for the success of any management programme that assembles stakeholders in a collaborative drive to reduce the problem of vandalism and pipeline failures to the lowest minimum. This will also expose the ROW to scrutiny and inspection by all stakeholders and the public so that product leakages owing to vandalism and natural causes are detected before they escalate in magnitude.

The success of this research in demarcating a 23km length of pipeline in Abuja has implications for the entire project of improving management of the pipeline network in Nigeria, according to frameworks amenable to the peculiar Nigerian national exigencies, as discussed in chapter eight. The length of petroleum pipeline shall be divided into strategic intervals of equal lengths across the country, using geographic information systems. With the use of the global positioning system (GPS) unit, ground control points could be captured at each of the strategic significant intervals along this length of the petroleum pipelines in Nigeria.

9.9 Sustaining post implementation collaboration

The implementation of the management plan for the ROW, and indeed any serious collaboration-based process for development, must take place under the authority of the governments, institutions, enterprises, communities and the people, as well as national or multinational organisations. As explained above, sustainable crisis-free management of public infrastructure, within the purview of the inherent corporate social contract between the government and the oil companies and the people, rests upon the pillars of environmental sustainability, economic sustainability and social sustainability.

With a new role for the local authorities in the management of the ROW, there is a need to shore-up their human capacity for operational efficiency in their organisational structure and in exercising their mandate. As this latter has been limited by federal laws towards dealing with planned and legal areas, under the current dispensation, they may be unable to divert resources to ROW which are by

statute the responsibility of the central government, but which affects poor rural lives for whom the local authorities are responsible.

Achieving the demarcation and post implementation of the ROW require funding which this study contends would be less that the financial costs of vandalism to the country over a period of one decade. An indicative statistical analysis evidencing the comparative advantage of implementing the collaborative approach over the present vandalism prone approach in financial terms is presented below.

9.9.1 Funding the new strategy

After demarcating the ROW, it is necessary to estimate the financial implications of the new strategy in relation to the financial and socio-economic losses being suffered by the country. As shown in chapters one and four, in a single decade, Nigeria has lost over US$2 billion in terms of both product and repair costs owing to pipeline vandalism. Furthermore, the terrain analyses presented here have shown that, of the 23km of pipeline traversed on foot in Abuja, about 10% was encroached upon by human settlement and commercially-cultivated trees. This translates to 2.3km on the 23km stretch of the ROW in Abuja. The standard compensation rate for demolishing household dwelling units on grounds of overriding public interest is 2 million Naira (US$10,000) (Muhammad Bashar *et al.*, 2010; Ocheje, 2007; Owei, 2007). Terrain analysis also shows that an average of 15 dwelling units was found on every 1km of the ROW encroached upon in Abuja. Extrapolating these indices onto the 7,000km length of the ROW in Nigeria produced two key results. These results are presented in Table 17 below.

Table 17: Financial requirements for monitoring the pipelines

	Activity	Cost (in US$)
1	Compensation across 10% of pipeline brought forward	105,000,000
2	Demarcating the 7,000km ROW x cost of demarcation/kilometre	28,000,000
4	Clearing the vegetation cover (cost of clearing encroachment x 1/4) = US$7,000,000 x 12 (annually) x10 years	740,000,000
5	Total	**834,000,000**

Source: Data analysis 2010

This research has shown that total loss owing to vandalism and cost of repairs in one decade is about US$2 billion (Nwankwo and Ezeobi, 2008; Ojeifo, 2008). It therefore follows that subtracting the estimated total estimated costs of technical services involved in demarcating and clearing the ROW, as calculated in Table 17, from US$ 2 billion leaves a positive balance of US$1.157 billion. A fraction of this balance could then be used to fund repairs and recurrent expenditure on the strategy nationally.

This shows that less than 50% of the estimated costs of vandalism to the country in monetary terms is needed to demarcate the ROW, pay the associated compensation to affected property owners and clear the ROW in order to make its 50m width visible across its over 7,000km length in Nigeria. The balance of over US$1 billion could be used to fund the procurement of services that will be required to maintain the ROW and keep away incompatible land uses.

9.9.2 Collaborating across sectors

With an expanded mandate for local planning authorities to cover the ROW, which was hitherto out of their remit, the new collaborative engagement with other governmental and non-governmental stakeholders entails a transformation process to ensure that the other stakeholders in the participatory process are not inhibited in the task of sustainably managing the newly demarcated ROW. The participation process itself requires that local authorities change their staffing structures to reflect their new mandate to enable stakeholder management of the ROW. This study shows that currently, staff members tend to be qualified for tasks in different sectors and as such are organised to provide a technical function. But to manage the multi-stakeholder interests in the ROW, local government needs to be repositioned to carry out the function to which it is most suited, by securing the collaboration of other interests relating to the pipeline, no matter how remote. The staff need to be re-oriented to the new requirement of performing functions of inter-agency coordination, encouraging activities rather than carrying them out, liaising between government and people (and between those who control implementation and those who can contribute relevant information and expertise) and other functions which do not fit into their traditional technical strengths. Horizontal co-ordination should be strengthened among the spatial environmental planning, financial, socio-economic, and

institutional activities to cover the strategic management of the ROW and other public infrastructures.

Development Plans will need to take cognisance of the pipelines and, therefore, take greater interest to ensure that their ROW is not encroached upon in the planning process. Planning procedures and implementation mechanisms must be related to the factors that contribute to encroachment on the ROW. If the planning area is dominated by particular concerns exhibited across the pipeline communities, representatives of those affected should be involved in the formulation and implementation of the plans. Where informal sector actors have developed large areas of pipeline communities, their representatives should be involved in official discussions over new directions for growth. Thus, planners should regard themselves as part of a team which would include public and private sectors, influential local groups, employers, entrepreneurs, and anyone else likely to be affected by the pipelines.

The power to make decisions and to finance development initiatives in pipeline communities should be devolved to the lowest level of governance that interfaces directly with the people in these communities, in order to maximise participation and engender a local sense of owning the ROW. The local authority management system should allow for communities and interest groups to have some involvement in decision-making on actions which directly affect them and by providing the opportunity for community involvement in project execution, operation and maintenance, infrastructures like the pipelines will be seen by the people as integral to their communities. Through a continuous and close collaborative interaction of all the stakeholders in the ROW, which is central to achieving a vandalism-free operation of the pipeline, the collaboration project is intended to establish an integrated system of public infrastructure planning and management institutions. These will result in a series of agreed strategies to deal with priority environmental issues affecting the operation of the pipelines and other transnational and regional linear infrastructures. The strategies will become part of a fully inter-related plan to provide a framework for consistent guidance on sustainable environmental development in the communities that host infrastructure such as the petroleum pipeline in Nigeria.

9.9.3 New set of skills for the new management framework

Devolving responsibility for pipeline ROW management to the third tier authorities in planning and environmental management will impact positively on finances and human resources at this level of environmental governance. Adjusting the work programme of local councils to cover the ROW will assist them to improve their planning and environmental management capabilities, particularly in the context of participatory and integrated approaches to development and management.

Devolution of responsibility from central government in respect of the pipelines will empower the people and the local authorities to stop or reduce vandalism to a minimum, thereby saving revenues that otherwise would have been forfeited in stolen products and the repair costs of vandalised pipelines. The monies so saved would be used to finance this proposed management framework across the three tiers of government in Nigeria, thereby opening a new stream of revenue for this tier of planning and environmental governance. The new regime of collaboration-based management will also improve the environmental management system, to the benefit of the residents of these low income areas scattered across the over 7,000km of pipeline in Nigeria. It will also reduce the susceptibility of the pipelines to vandalism since the communities would now be empowered to act positively on the pipeline and its associated ROW.

9.9.4 Addressing the key challenges in the case studies

As discussed in chapter seven, the communities that are located near the ROW in Nigeria are directly affected by vandalism activities on the network of pipelines. The collaborative framework proposed by this study offers an alternative to the present situation by introducing sustainability into the pipeline community's socio-economic activities, in order to mobilise the local people for participation in their management. Employing community members in ROW monitoring resonates across all the case studies. This will impact on the local economies in these communities by providing many jobs for otherwise unemployed people and give them training opportunities as they interact with the other stakeholders at various levels of government and in the multinational oil companies. This will engender a process that will see the locals transiting into employment in the government agencies and the multinational oil

companies, thereby creating further opportunities and enlightenment in the communities. The collaborative framework will create a chain of activities that promotes good practices in environmental management.

9.9.5 Imperative for partnership amongst stakeholders

In tandem with measures to prevent the use of environmentally sensitive or unsuitable land for development, the collaboration-based framework for management of the ROW and the communities around it enables the local authorities, through the democratic processes it has facilitated, to direct community growth, by installing infrastructure that reorients community expansion away from the pipeline areas. In this respect there needs to be more basic servicing in advance of development or the demarcation of clusters of plots by installing roads that can serve to direct development. In addition, multi-sectoral investment planning and public/private partnerships may provide resources to enable development in particular directions or for particular purposes. In encouraging local rural economic growth in the pipeline communities, informal economic activities could be promoted across the ROW, using the funds realised from a drastic reduction in pipeline vandalism. Within the larger economy, encouraging the informal sector in specific areas such as the construction industry or small-scale enterprises, can improve housing supply and employment at the same time (UNCHS, 1995). Such involvement by the public sector should be accompanied by transparency in accounting and full cost recovery except where development is successfully targeted to very poor vulnerable groups that are prone to recruitment by vandal barons.

A collaboration-based ROW management, in which public sector institutions and the multinational oil companies cooperate with the people, requires a new institutional framework to bring local initiatives by citizens and community organisations before local authorities for their attention. Local non-governmental organisations (NGOs) can contribute significantly in such liaison tasks; and as technical advisers, as trainers, and as institutions which help community organisations negotiate with power structures for financial resources, to provide basic amenities that will placate the aggrieved community members and gain their confidence to ensure that vandalism is not aided.

9.9.6 Putting the ROW to economic use

There is a need to put to economic use the 3,500 hectares of land that have come under the ROW of the pipeline by operation of the law across the pipeline communities in Nigeria (Brume, 2007; National Assembly Nigeria, 1990c; National Assembly Nigeria, 1990d). All land across the ROW in Nigeria is within the administrative jurisdiction of a local authority, but vested in the governor of the relevant state, who administers the land on behalf of the people. The governor delegates authority for land administration within the jurisdiction of local government areas, to the respective local authorities. These have a role in supervising land use according to the dictates of the plan, and in putting it to the optimal use, including unused or under-utilised land owned by public agencies, which includes the land around ROW.

ROW land-use policies should also consider the cultural, recreational and ecological value of land to the people. Human settlements should have certain undeveloped areas, for example, parks, plazas and areas of natural beauty, such as land alongside the sea or river or hills. The central government could empower the local authorities to designate the ROW as a land-use of national significance.

The ROW could be developed for tourism, sports and other recreational uses, in particular for the communities traversed by the pipelines, and more generally for the citizens of the country as a whole. The ROW provide easy access to land which is not built up, where it is safe to play (under the foreseen managed conditions) and where natural beauty can be seen and experienced. Uniquely, this would give the children in the communities the opportunity to access natural sporting and recreational facilities for healthy growth and physical and mental development. The ROW could be planned to serve this purpose, which holds the potential of changing people's attitudes about it and also ensuring that it is not void of positive activities which could dispel negative tendencies like vandalism.

9.9.7 Providing local action for mitigating effects of vandalism

This research has shown that the problem of vandalism, which started in the Niger Delta region as a form of protest against perceived government and oil company neglect, has become widespread across the net work of pipelines. The ROW has

become synonymous with disaster in the communities it traverses. Because of the complexities of the issues that have resulted in the phenomenon of pipeline vandalism and the associated conflagrations, two community local authority action levels are being proposed. These are given below.

9.9.8 Enabling community level initiatives

The involvement of non-governmental organisations (NGOs), in particular of professional organisations, is important for development, in cooperation with their community-based counterparts, of the culture of safety among local communities (Teegen et al., 2004; Agbola, 1994). Non-governmental, civil society and community-based organisations around the pipelines could be activated to translate the declared corporate social responsibility obligations of multinational oil companies and the national oil company in Nigeria into tangible programmes of action that promote the ideals of sustainability on the ROW.

International and national NGOs, such as the National Committee of the Red Cross in Nigeria and the United Nations Development Programme, have proven their efficiency in carrying out disaster relief activities, even in complex physical and political environments similar to those of the host communities' of pipelines and other petroleum infrastructures in Nigeria (Dijkzeul, 2006; Borrini et al., 2004). In implementing this in the ROW in Nigeria, the dictates of the organisations within the United Nations system, such as the United Nations Environmental Programme (UNEP), should be appropriated for the development of the capacity of local authorities, NGOs and CBOs to act in a state of emergency and to manage the hazards associated with the ROW because of vandalism.

9.10 Evolving national and state level actions

The government, at the national level in Nigeria, is constitutionally responsible for providing certain services envisaged in an exclusive list that forms part of the 1999 Nigerian constitution (National Assembly Nigeria, 1999). As noted, petroleum prospecting and transportation is included in this list, putting exercise of control over it as the exclusive preserve of the federal government in Nigeria. However, the same constitution has also mandated the federal government with responsibility for

ensuring that local authorities have the necessary powers, personnel and resources to sustain good quality infrastructure and services throughout the states they supervise.

Thus, governments at the federal and state levels should assume a key role in promoting sustainable development, which is so easily beset by disasters caused by pipeline vandalism in the country, by providing:

i. The institutional structure to provide and maintain basic infrastructure and services and to do so in response to local needs and priorities. This should include an effective pricing structure which ensures that those who benefit most from land, publicly-funded infrastructure and services pay a realistic price for them and the very poor across the ROW who live on less than $1 per day have these services subsidised to enable their affordability;

ii. The regulatory and incentive structure to encourage more sustainable levels of resource use that dissuades the people from encroaching on the ROW. This could include, for instance, incentives to encourage people to move away from the pipelines which, as is currently the case, are having serious negative environmental impacts, and to turn to other areas of their communities that will ensure less damaging impacts from vandalism.

iii. Creating a socio-economic environment to support and encourage the initiatives of individuals and their community organisations to improve living conditions, or in other ways contribute to development goals. In poorer deprived neighbourhoods in the communities, this will also include supporting joint ventures between governments and community organisations to improve infrastructure and service provision.

iv. The financial resources for promoting national sustainable community development objectives at local authority level. This will impact positively on the pipeline communities and give them the leverage to move away from the hazard-prone ROW.

v. The policy and fiscal environment which allows local authorities to make land management decisions and have the resources to guide development along the ROW. This includes the political will to devolve power downwards, and encourage training and career development for local

authority personnel on a national scale; and as a matter of policy encourage them to engage with communities in their domain of administration, with particular reference to the communities along the ROW of petroleum pipelines.

vi. A national physical plan developed to guide land resources development and use along the over 7,000 km of pipeline ROW. This would provide a context in which regional and local land use planning can be carried out effectively, while incorporating the ROW.

9.11 Creating a land data bank to empower the people

This study has shown that one of the problems of compensation payment over the past four decades is the issue of spiralling growth in the number of compensation claimants over the lands taken from the communities for pipeline projects across the country. This is because over the years, the number of those eligible for compensation has naturally multiplied owing to procreation in the compensation-seeking families within the ROW communities.

This has been possible because land in most of these communities has not been registered, and hence any heirs of the affected families automatically become eligible for compensation on reaching 18, the statutory age of maturity in Nigeria (National Assembly Nigeria, 1999). Introduction of land registration will serve to limit ownership of particular pieces of land to the identifiable adults at the time the land is registered. This will ensure that heirs attaining the age of maturity thereafter do not become independent claimants.

This research has also recognised the need for quality control and the necessity to distinguish between what is feasible under the local circumstances of the ROW and what is desirable or ideal. Given the circumstances of rural communities in Nigeria generally, and the goal of achieving coverage of all identifiable properties in the ROW communities, it should be possible to accept approximate surveys for the purposes of land registration in the short term, in order to encourage those with traditional claims to land to submit to land registration. Furthermore, the owners of unregistered parcels of land can be issued with temporary permits as a first step in the land registration process. After verification of their claim to the identified parcel

of land, certificates of rights to land will then be granted to them. Government guarantees should stand behind any form of land registration, but they may be focused on ownership rather than on the precise boundaries of the land parcel, in order to stop the problem of generational multiplication in the eligible compensation seekers for particular parcels of land within ROW communities.

9.12 Mobilisation and distribution of resources

Resource constraint was identified as one of the most serious problems in pipeline disaster relief operations in Nigeria. National planning efforts for disaster mitigation generally are important for mobilising resources and equitably distributing them in accordance with need on a national basis, with particular reference to the corridors created by the pipelines across the country. The federal government should ensure, through appropriate legal and administrative frameworks, that disaster preparedness and response constitute a major component in planning and financing developmental activities in the oil producing and pipeline communities. They should be planned for on a medium to long-term basis, not as a reaction to a catastrophe as is presently the case. The central government must ensure that priority protection works are carried out and resources should be provided wherever they may be needed for regional or local authority actions, as may be appropriate.

9.13 Policy Recommendations

9.13.1 Towards a collaboration-based management framework

According to Ayre and Callway (2005), most of the advocacy and interventionist works of the United Nations Commission for Human Settlement and other United Nations bodies have tended towards achieving sustainable development and improvement in human settlements with particular focus on the living environment (UNCHS, 1995). In tandem with the finding of this study, implementing Agenda 21 complements the broad research objective of achieving improvements in the standards of living in the pipeline communities, and equipping people, who are mostly engaged in agrarian activities for subsistence, with the needed skills that will ensure that they engage their environment in a way that promotes ecological

sustainability. This will engender a ROW development and management framework that is efficient, transparent and accountable, and also re-orients people to work collaboratively in achieving the goals of Agenda 21, by creating within the communities, practices that are capable of balancing and achieving the primary goals of productivity, poverty reduction and environmental protection. Adopting this approach will also promote inter-agency working and participation of all stakeholders in the mostly rural pipeline communities, allowing local authorities to their shift focus from one of controlling to one of enabling sustainability initiatives, in order to get the people living near the disaster prone ROW to realise the inherent dangers in their home location. This will make for easy controlling of community expansion away from the ROW.

9.13.2 Directing the community growth pattern

This research has shown that if the communities expand away from the ROW, their level of exposure to the possibility of the negative externalities of vandalism will likewise reduce. To move the growth pattern of the communities away from encroaching further on the ROW, Sustainable Land-Use Planning and Management, which provides for the land requirements of the people in alternative safe locations, must be promoted through a collaboration-based plan that is environmentally sound. In the pipeline communities, this must involve promoting, advancing, monitoring and assessing land policies and strategies.

This will also entail periodic review of the impacts of land and community expansion-related activities on the ROW, analysis of procedures, regulations and instruments for the proactive engagement of the people in the management of the ROW, and the formulation and implementation of land planning policies that reflect the physical development needs of the people. Local authorities with jurisdiction over the ROW communities, should encourage and assist them through a programme of actions that stimulate the allocation of adequate supplies of land away from the pipelines to meet the requirements of orderly and equitable community development, particularly to meet the housing needs of low income groups and women who have remain helplessly located along the hazard prone ROW because of lack of resources to relocate to safer areas. This includes measures to encourage the private sector to increase the supply of land, improve

administrative and technical capacities for land registration, and legal reforms to promote the efficiency of land markets. Improving access to land by low-income groups has significant impacts on poverty alleviation and on reducing social inequities, which are a major problem in the communities (Mahanty et al., 2009; Bird and Rodriguez, 1999).

This study also shows that land is considered a very important resource by the people in the ROW communities. Given the importance of land to the pipeline communities, equitable land management and land-use planning is a critical factor for the success of any conscious effort at attracting the collaboration of the people in the management of the pipelines that traverse their communities. As revealed by this research, given the scale of land-related compensation problems, efforts inside and outside the current central government pipeline management system, have not been able to resolve the challenges. This deserves the immediate attention of decision-makers and those concerned with the management of the ROW in embracing the collaboration-based management approach proposed by this study.

9.13.3 Characteristics of the proposed framework

A major objective of the collaboration-based management of the ROW of petroleum pipelines in Nigeria is to stem the excessive losses that this study has shown to have been the consequence of vandalism, and other pipeline-induced disasters, that have incessantly affected the people in these communities. By a community-oriented planning and management of the land, the collaboration-based framework will work to achieve a reduction in the risk of pipeline disaster occurrence, by:

i.   Reducing the vulnerability of ROW communities to pipeline disaster-related damage;

ii. Preventing the undertaking of activities such as locating new buildings on the ROW, which increase the risk of pipeline related disasters; as well as controlling environmental changes which lead to such risk;

iii. Appropriate preparedness to act in cases of pipeline-induced emergency and in co-ordinating response to disaster;

iv. Increasing the ability of the people to immediately begin the task of rehabilitation and reconstruction, this not only restores, but also improves the quality and sustainability of their communities.

Having outlined the key stages in pipeline disaster preparedness and reduction through appropriate planning and land management programmes, there is a need to articulate a clearly defined implementation strategy to translate the programme into workable solutions. The sections proposed are:

i. Developing a culture of safety and understanding of the methods for natural hazard management among the general public and all agents involved in the development process;

ii. Enhancing physical development planning and management;

iii. Encouraging preparedness activities and building the institutional and community capacity to act in a state of emergency and

iv. Providing for a continuum from reconstruction to development.

As revealed by this study, most pipeline disaster-related relief activities in the ROW communities in Nigeria have been in the form of isolated relief for the people. They have consisted mainly in reconstruction activities, rather than activities framed within co-ordinated programmes that incorporate a concern about these frequently occurring pipeline disasters into overall development strategies for the affected people. The collaboration-based management approach will enable the government to make substantial savings in terms of revenue from oil that would have been lost to vandalism and the costs of pipeline repair. These savings could then be used for capacity-building for the management of vandalism-related and natural hazards.

9.13.4 Mitigating the effects of pipeline vandalism

The collaboration-based framework is in tandem with the expectations of the United Nations Commission on Humanitarian Relief, which has taken broad policy steps to ensure that human and other disasters do not transmit into environmental catastrophes (Murphy, 1996). To achieve this goal, the following guidelines are necessary in guiding the planning process in the ROW communities (Oloruntoba and Gray, 2006; Cooley and Ron, 2002). Pipeline-

related disaster preparedness and planning seem to become a priority only after the disaster has already occurred and losses incurred, rather than being integrated into the sustainable development programmes of the ROW communities. Deliberate programmes of disaster preparedness in the ROW communities have never been put in place across the communities. To reverse this trend, the following actions must be taken to engender a process that links pipeline-disaster preparedness, prevention, mitigation, emergency response, rehabilitation and reconstruction to any sustainable development programmes proposal for the communities:

i. Technical assistance programmes to build the capacity of state and local authorities as well as of the local communities and their community-based organisations in the management of vandalism-induced and natural hazard;

ii. Supporting the establishment of national, state and local early warning systems and facilitating the access of local communities and the private sector to information on vandalism-induced environmental problems and other hazards;

iii. Improving the cooperation of the organisations within the national emergency management system for quick response to vandalism-related and natural disaster distress calls from the communities;

iv. Building an understanding that development planning and control, incorporating measures to prevent the deterioration of natural environment around the pipelines, are essential for averting excessive losses in the wake of pipeline vandalism-induced disasters.

To achieve success in implementing the sustainable development programmes proposal for the communities in order to reduce their susceptibility to vandalism-induced disasters, a deliberate strategy must be prescribed.

9.14 Integrating the stakeholders framework

To achieve sustainable environmental development and effective land management within the ROW communities in Nigeria, the following implementation principles are necessary to promote the involvement of the people as stakeholders. As revealed by this research, attending to issues that have to do with vandalism-induced disaster

management, the following principles which underline sustainable development are necessary to drive the implementation of collaboration-based management. The principles include the following:

9.14.1 Subsidiary of mandate in ROW management

Subsidiarity in respect of vandalism-related and other types of environmental problems in the communities can be achieved through decentralising responsibility from central government to the local planning authorities and ROW community-based organisations as far as is possible, to enable the communities to act to their level of competence in dealing with vandalism-induced and other disasters, prior to the arrival of further support from state and federal sources. Decentralisation, which is at the heart of sustainable development, involves transferring power from the centre to communities, so that local responses can meet local issues. To make local action sustainable, revenue raised to finance local agendas should be under local control but funded by federal sources, drawing from the revenue that would formerly have been lost to vandalism and in repair costs (Haughton and Counsell, 2004; Scott and Gough, 2003).

9.14.2 Participation of the people

As shown by this study, the people need to be encouraged to participate in the management of the pipeline which has been the source of various challenges, ranging from infernos and land contamination to oil spillage in their communities. Policy-making in respect of the management of the ROW should be participatory, so that all actors in the development process can have a part in making the decisions and, therefore, have responsibility to implement them. This maximises the chances that scarce funds are spent in a way which addresses what are perceived locally to be the most pressing problems.

9.14.3 Training the people for the framework

The oil companies and local authorities should empower local communities through appropriate training programmes, to enable them to have the knowledge and power to run their own affairs, as far as possible, and to represent themselves with confidence in the socio-political processes that affect them. The Community

Contracts Programme in Sri Lanka (Berner and Phillips, 2005; Choguill, 1996) has shown that local action, rendered sustainable by being profitable as well as socially positive, can empower people to improve their own quality of life. Involvement in the management of the ROW in a profitable manner will attract more responsive interest from the people.

9.14.4 Responding to community needs through policy

In the light of the above, therefore, planning and development should be responsive to high priority issues and the needs of the most vulnerable groups in the ROW communities, in balance with the sustainable use of resources available to the community and ROW management. The priority of the people in the pipeline communities as revealed by this research is the expected payment of compensation for their land which was taken for the pipeline and other petroleum projects over three decades ago. The community members feel threatened by the escalating cases of vandalism which has not only caused the destruction of their agrarian means of livelihood and increased the pool of the poor among them, but has cost the communities in human lives and contamination of the environment. It is their consensus that a collaboration-based management programme that responds to issues of vandalism, explosions and the misery they create, is necessary to reassure the people that the pipeline and other petroleum infrastructures within their communities could operate to empower the people through employment and community infrastructure development financing in a transparent way.

9.14.5 Achieving transparency

As revealed by this study, accountability and transparency in the administration of expected community benefits from oil and gas revenue has always been at the heart of community actions and grievances against the multi-national oil companies and the pipelines. In addressing the mistrust already created in the minds of the people, local people should be part of decision-making about community projects, so those responsible for planning and overseeing implementation will be accountable to people, not only in the short term but also over the life of the project. Transparency is an essential requirement for an all-inclusive sustainable development in the ROW communities.

9.14.6 Host-community as a stakeholder

As shown by this study, the communities have always been excluded from any forum where their issues were discussed, because of the notion that external consultants working for the government and oil companies know their developmental needs and challenges better. This has always led to the conception and implementation of projects that run contrary to the aspirations of the people. To achieve a situation where the people will embrace the project and also engage in its long-term maintenance, the policies aimed at them should be formulated with their active participation. The inclusion of socially and economically marginalised groups should be recognised as a fundamental premise of policies for development in the ROW communities. Thus, governments at the federal, state and local authority levels should adopt poverty alleviation measures, such as paying for ROW maintenance, community contracts for infrastructure work, and direct assistance to those living in absolute poverty within the communities as a way of realising a change in their perceptions about the pipelines.

9.14.7 Collaboration with the people in their development

This study has shown that failed expectations also form part of the grievances of the people in the communities. Promises of relief interventions from both the government and the multi-national oil companies have hardly been fulfilled, creating mistrust in the already strained relationship between these organisations and the communities. The people should be involved from the outset, so that the package of measures decided upon for communities will be in tandem with their expectations. This will impact positively on people's capacity to participate and co-operate with the agencies that have a statutory or economic interest in their communities due to the pipelines.

9.14.8 Collaboration-based working of agencies

Addressing the problem of vandalism in the ROW communities in Nigeria needs be within a collaboration-based framework that attends to the grievances of the people. This is achievable within the purview of sustainable development, which in the context of the ROW of these communities should be imaginative, especially as a means of capturing benefits of community development and increased wealth for

ordinary people, and as a platform that fosters public-private partnerships for the benefit of the communities. Multi-stakeholder teams consisting of formal and informal interest groups should be formed to manage the framework at the local administration level so that those making strategic decisions are not only known to the people, but are in effect influenced by the people.

A collaboration-based approach, which this study has shown to be the strong preference of the communities, requires public relations, promotional, and entrepreneurial skills which could have cumulative effects on the skills levels of the people.

Involving community members as stakeholders for the management of the ROW will engender participation of the members of the community, and build synergy that has a base in the communities for management of the ROW. Ripple economic effects will flow into the community from paid employment, from which community members employed to work on the ROW would benefit. The multiplier effect of this will be the creation of other businesses that will also employ more of the people, based on the payments received by those employed to watch over the pipelines. Provision of employment will reduce the number of unemployed youth who can be easily swayed to criminal activities, as unemployment is one of the prevailing indicators of poverty in Nigeria (Department for International Development, 2008; World Bank, 2004).

9.15 Contributions to knowledge and limitations

The distinctive contributions to knowledge and limitations associated with this study have been noted. In doing this, the research aim and objectives articulated in chapter one were compared with the gap in knowledge discovered through the review of literature and the findings from the case studies. Drawing on these findings suggests that this study contributes to knowledge from both a theoretical perspective and in relation to practical applications. However, the research is not without its limitations. This section starts by itemising the contributions of the study to knowledge and ends with an account of the limitations encountered in the course of the research.

9.15.1 Theoretical contributions

Building upon the preliminary readings and the literature reviewed in chapter two, this study first refined the concept of a Collaboration-Based Management of Petroleum Pipeline ROW to embrace all aspects of sustainability in petroleum infrastructure management. It propounded a rationale for stakeholders' collaboration in the management of public infrastructure as a way of responding to the needs of promoting sustainability in social, economic and environmental terms. The collaboration-based management of the ROW is about harnessing all contending interests to facilitate consensual efforts at socio-economic and environmental sustainability in the pipeline network, so that it can benefit all stakeholders. The study also argued that the inherent fiduciary social contract of businesses to their host-communities encapsulated in terms of corporate social responsibility can find expression in collaborative planning for the goal of achieving sustainable development.

Drawing on this, the study advanced three theoretical arguments. Firstly, it argued the need for collaboration in the management framework for the ROW and that this should include all stakeholders with interests in the network of pipeline. In this sense, it contends that attempts to restrict the participation of any stakeholder in the management framework will bias the concept of a Collaboration-Based Management. The second argument made was that collaborative planning practice can be activated to express the ideals of corporate social responsibility for the achievement of sustainable environmental management, particularly, within the purview of of sustainable development. This would operate to mitigate the harsh socio-economic and environmental conditions that underpin the explanation of the socio-economic conditions of the commons in the ROW communities. The third argument concerned the question of who benefits from Collaboration-Based Management of the ROW of Pipelines, where it was contended that the fundamental feature is the recognition of all stakeholders within an all-inclusive framework, which would ensure justice for all the interests.

The foregoing arguments are normative in nature, following the traditions of the planning discipline. Drawing from these arguments, this research maintains that understanding the holistic meaning of infrastructure and, in this case, petroleum

pipeline and its associated ROW and re-defining it to serve developmental purposes for all stakeholders, is essential for critical national infrastructure to be managed. Local and national development activities need not only to address economic growth but also to balance social and environmental sustainability. Infrastructural development planning needs to facilitate cohesive collaboration between all the stakeholders for its post-implementation management in order to promote a higher quality of place in the communities where it is located.

9.15.2 Practical contributions

Based on the research objectives and the presentation of the research context, there is a need to demarcate the ROW as a first step in the effort to develop a management framework for the ROW of petroleum pipelines in Nigeria. To achieve this goal, a geographic information systems-based programme was implemented and successfully demarcated the ROW of petroleum pipeline for demarcating the ROW was developed in chapter five. In chapter six, this programme over a 23km stretch of the pipeline, from Kwali to Abaji in Abuja.

This has produced a definite programme of practical application for demarcating the over 7,000km length of the pipeline in Nigeria. In addition, this programme also has capacity to integrate continuously updated information on environmental changes along the ROW and for monitoring against unauthorised activities on them. This groundbreaking GIS-based programme developed for demarcating and management of the ROW could also be used for demarcating and managing the ROW of other linear infrastructures.

9.16 Limitations

This research, like other case study research, has limitations associated with it. The first are some methodological limitations associated with the research such as the representativeness of the data of the case studies selected and of the sampling within these and the potential impact of this on the research findings. Because the subject matter of the research is the over 7,000km length of the pipeline that traverses the entire landscape of Nigeria and an avalanche of stakeholders across the ROW communities, it is practically impossible for a piece of doctoral research to collect

data from all of them. Although efforts have been made to extrapolate the data and the findings, it cannot be said to wholly be free of possible bias.

In terms of generalising the research findings, since the case studies seek to reveal relationships and processes in the manifestations of the negative externalities of the pipelines on the environment and the ROW communities, it is necessarily constrained to draw general conclusions from its findings.

Secondly, given the exigencies of the doctoral research, a substantial part of the data for the research was generated from secondary sources. This introduced the possibility of missing out the tacit knowledge first hand data provides, because secondary data may have undergone transformation, with implications for its veracity.

Thirdly, physical demarcation of the ROW was done over an approximately 23km stretch of the pipeline network, which translates into about 10% of the pipeline length in Abuja, which itself is only one of the 37 Federating Administrative Units in Nigeria, a country with varied geographical characteristics from the northern to the southern region. The terrain challenges may vary with the changing geographies and may make application of the GIS-based programme for demarcating the ROW more onerous in the more challenging terrain found in the southern region of the country.

9.17 Recommendations for future research

This research has shown that the challenges in the management of the ROW of petroleum pipeline in Nigeria present a different paradigm compared to the challenges found in other parts of the world. This gives rise to other questions that can be explored further to advance research in linear infrastructure management planning within the context of collaborative planning and spatial statistics.

Firstly, why are there variations in pipeline management challenges across the globe? Secondly, are there challenges underpinning the management of petroleum pipeline ROW that traverse international boundaries? In this context, can there be convergence in international jurisprudence to ensure that ROW is collaboratively managed for the greater interests of all the countries?

Thirdly, case study analysis revealed that the bunkering of oil pipeline for theft of its transported products in Nigeria is done with the active collaboration of nationals of other countries and that the apparent success and affluence of those involved in the illicit activity has been an attraction to many who are without occupation. This raises the question of non-Nigerian nationals' level of participation and how are they recruited. How do they dispose of the oil stolen from Nigeria? The fourth question is raised of international trade in oil and gas and the possibility of branding and restricting trade in stolen oil from Nigeria.

These are the further research questions that are related to the current study. In addition, however, with regard to the theoretical underpinnings of Linear Infrastructure Management in general, and particularly, Collaboration-Based Management of Petroleum Pipeline ROW in Nigeria, as revealed in the literature review, the question remains as to how to develop an integrated host-community specific development index, for evaluating the precise development needs of communities traversed by major public infrastructures as a follow-up to this study. All these questions call for further theoretical and empirical enquiry.

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Appendix

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Appendix 1: Survey questionnaire

CONFIDENTIAL OPINION SURVEY QUESTIONAIRE **FOR ACADEMIC RESEARCH USE ONLY**	**Newcastle University** **UNITED KINGDOM**

This survey is part of a research on Geographic Information Systems enabled Collaborative Management of Petroleum Pipeline Right of Way in Nigeria. Please fill in this questionnaire and answer the questions as accurately as possible. All information provided will be treated in strict confidence and used for academic purpose only.
Thank you

Unite Simon Ekwo
PhD Research Candidate
School of Architecture, Planning & Landscape
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SECTION 1: PETROLEUM PIPELINES AWARENESS
Are you aware of the existence of petroleum pipeline passing through your community?
(a) Yes (b) No (c) Not Applicable
Are you aware of any law protecting the right of way of petroleum pipeline in Nigeria?
(a) Yes   (b) No (c) Not Applicable
How close is your community to petroleum pipeline?
   (a) Less than 12.5 meter   (b) More than 12.5 meter (c) Don't know (d) Not Applicable
 Do you cross pipeline rights of way in the course of your daily activities?
(a) Yes (b) No (c) Not Applicable
  Was your community compensated for the land taken for pipeline project?
(a) Yes (b) No (c) Don't know (d) Not Applicable
 What do you feel about the petroleum products pipeline in your community land?
(a) Happy (b) Angry (c) Don't know
 Have your community experienced petroleum pipeline vandalism before?
 (a) Yes (b) No (c) Don't know (d) Not Applicable
 If your response to question 7 above is yes, who was responsible?
(a) My community people (b) People from elsewhere (c) Don't know
 Have you lost loved ones to petroleum pipeline fire?
(a) Yes (b) No (c) Don't know (d) Not Applicable
 Have you lost property to petroleum pipelines fire?
 (a) Yes (b) No (c) Don't know (d) Not Applicable
 Do communities in your area protest against government policies through pipeline vandalism? (a) Yes (b) No (c) Don't know (d) Not Applicable
………………………………………………………………………………………………
…

unitesimonekwo@yahoo.com

SECTION 2: Please indicate your level of agreement with each of the following effects as it relates to petroleum pipeline rights of way in Nigeria by ticking as appropriate.

12. Pipeline rights of way separates communities and hinder inter-community movement

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

13. Pipeline rights of way causes loss of farmlands and impoverishes communities

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

14. Pipeline and its rights of way causes oil spillage in communities close to it

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

15. Community members should protect pipelines in their community

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

16. Sacred community land is lost to Pipeline rights of way

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

17. Communities feel threatened by petroleum products pipeline passing through it

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

18. Petroleum Products Pipeline rights of way constitute public health hazard in communities

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

19. Petroleum Products Pipeline rights of way destroys community amenity

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

20. Petroleum Products Pipeline rights of way causes increase in criminal activities in communities

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

21. Eye–sore is created by non maintenance Petroleum Products Pipeline rights of way

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

22. Petroleum Products Pipeline rights of way destroys community landscape

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

23. Petroleum Products Pipeline rights of way increases travel distance between communities

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

24. Petroleum Products Pipeline rights of way Promotes violent crimes levels in your community

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

25. Petroleum Products Pipeline rights of way fosters general inter-community access

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

26. Petroleum Products Pipeline rights of way pose hazard to public safety

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

27. Petroleum Products Pipeline rights of way causes Soil and Water Contamination when vandalised

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

28. Petroleum Products Pipeline rights of way pose risk of fire outbreaks to your community

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

29. Petroleum Products Pipeline rights of way distorts community growth pattern

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

30. It is necessary for people to cross pipeline in the course of daily activities

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

31. Petroleum Pipeline is beneficial land use to you

5.Agree Strongly	4. Agree	3.Neither agree or disagree	2. Disagree	1.Disagree Strongly	0. Don't know

………………………………………………………………………………………………

SECTION 3: PERSONAL PROFILE

32. What is your Sex?

Male	Female

33Marital Status:

Single	Married	Widowed	separated

34. Which is your Age Bracket?

18 – 24	25-29	30-34	35-39	40-44	45-49
50-54	55-59	60 and above			

35. Are you a native of this community?

Yes	No

36. How long have you lived/worked in this community?

Less than five years	more than five years

37. What level of education have you completed?

No formal education	primary education	Secondary education	Tertiary Education

38. What Religion do you practice?

Traditional	Islam	Christianity	others

39. What is your type of occupation?

Self employed	Public Sector	Private sector

40. What is your Nationality?

41. What is the name of your State of Origin?

42. What is your State of Residence?

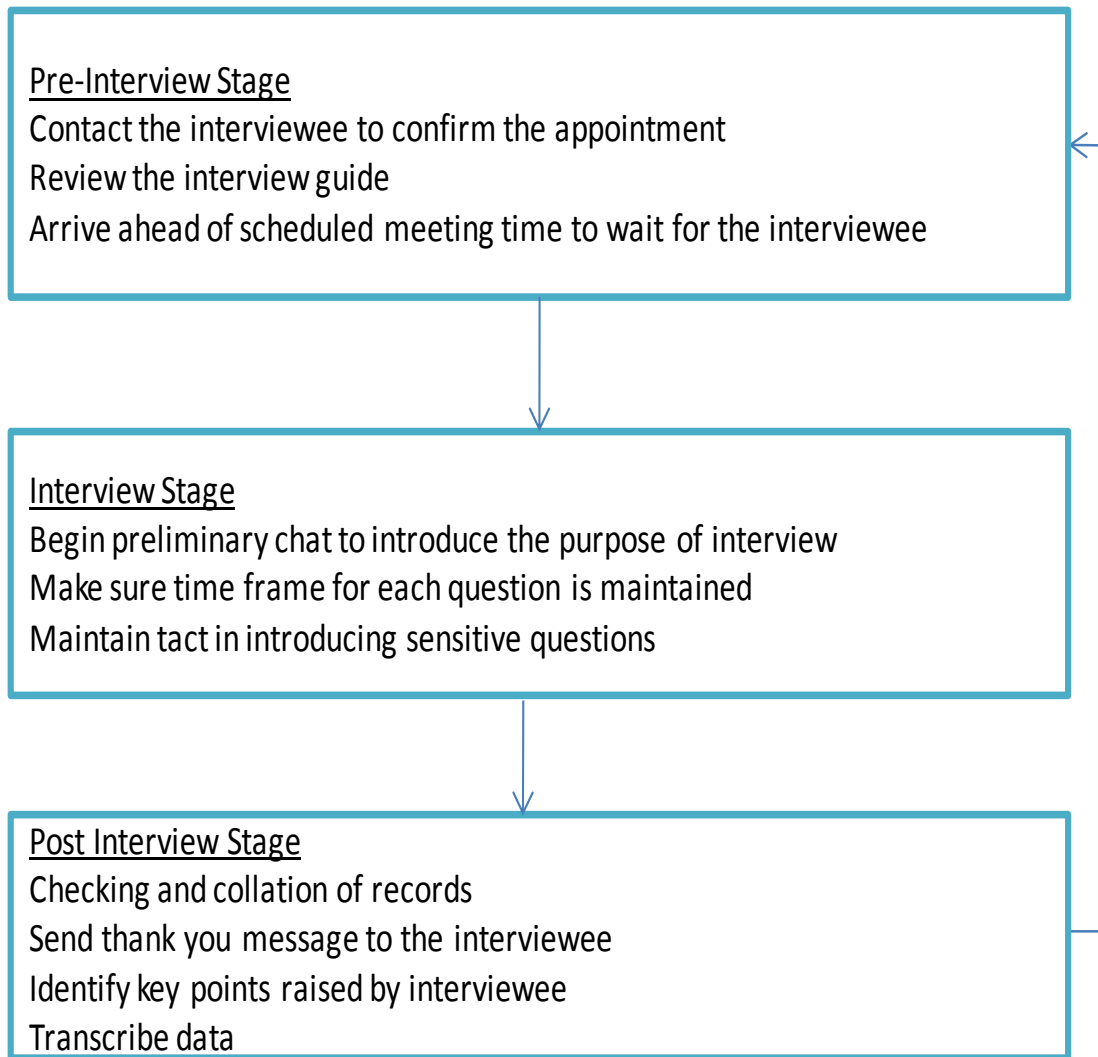43. What is the name of your Local Government Area of Residence?

44. What is the name of Community of Residence?

45What is the name of your employer?

Appendix 2: Interview schedule

Pre-Interview Stage
Contact the interviewee to confirm the appointment
Review the interview guide
Arrive ahead of scheduled meeting time to wait for the interviewee

Interview Stage
Begin preliminary chat to introduce the purpose of interview
Make sure time frame for each question is maintained
Maintain tact in introducing sensitive questions

Post Interview Stage
Checking and collation of records
Send thank you message to the interviewee
Identify key points raised by interviewee
Transcribe data

unitesimonekwo@yahoo.com

Appendix 3: Introduction letter 1

Newcastle University

20th August 2008

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United Kingdom

Managing Director
National Emergency Management Agency
Maitama Abuja

To The Managing Director

RE: Unite Simon Ekwo, Student Number 069049880

I write with regards to the above named student who is currently undertaking a PhD within the School of Architecture, Planning and Landscape at Newcastle University.

His research relates to the use of Geographic Information Systems and Spatial Planning for the Management of Petroleum Pipeline Rights of Way in Nigeria. As part of the PhD requirements, he is due to embark on fieldwork that will take him through the Right of Way of Petroleum Pipeline in Benue, Rivers and Lagos States as well as Abuja and Enugu State to collect data.

I would be grateful if you could assist Mr Ekwo with the necessary logistics and data during his fieldwork in Nigeria.

Please do not hesitate to contact the School with any queries you may have.

Yours faithfully

Dr Graham Tipple
PhD Supervisor
Architecture, Planning and Landscape
Newcastle University

a.g.tipple@ncl.ac.uk
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Appendix 4: Introduction letter 2

Newcastle University

School of Architecture, Planning
and Landscape

20th August 2008

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United Kingdom

To Whom It May Concern:

RE: Unite Simon Ekwo, Student Number 069049880

I write with regards to the above named student who is currently undertaking a PhD within the School of Architecture, Planning and Landscape at Newcastle University.

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Please do not hesitate to contact the School with any queries you may have.

Yours faithfully

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Appendix 5: Introduction letter 3

Newcastle University

20th August 2008

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United Kingdom

Managing Director
Pipeline Products Marketing Company
Nigerian National Petroleum Corporation
Abuja

To The Managing Director

RE: Unite Simon Ekwo, Student Number 069049880

I write with regards to the above named student who is currently undertaking a PhD within the School of Architecture, Planning and Landscape at Newcastle University.

His research relates to the use of Geographic Information Systems and Spatial Planning for the Management of Petroleum Pipeline Rights of Way in Nigeria. As part of the PhD requirements, he is due to embark on fieldwork that will take him through the Right of Way of Petroleum Pipeline in Benue, Rivers and Lagos States as well as Abuja and Enugu State to collect data.

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Yours faithfully

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Appendix 6: Introduction letter 4

Newcastle University

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

Executive Chairman
Economic and Financial Crimes Commission
Abuja
Nigeria

Dear Sir

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

Mr Ekwo will be travelling to Nigeria to undertake field work essential for his research. I would be very grateful if all the relevant institutions that Mr Ekwo visits would be able to offer all the necessary assistance to facilitate this work and in particular he will be carrying out a series of focus group and structured interviews with various stakeholders on the issue of petroleum pipeline, GPS related digital mapping and ground control points acquisition during the months of February to March 2009 as part of his research. He will undertake the fieldwork in parts of Abuja, the Nigerian Federal Capital Territory, Benue, Enugu, Rivers and Lagos States

If you have any queries, please contact me.

Yours faithfully

Dr Graham Tipple
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Appendix 7: Introduction letter 5

Newcastle University

School of Architecture, Planning
and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

To Whom It May Concern:

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

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If you have any queries, please contact me.

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Appendix 8: Introduction letter 6

Newcastle University

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

Director General
National Emergency Agency
Abuja
Nigeria

Dear Sir

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

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If you have any queries, please contact me.

Yours faithfully

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Appendix 9: Introduction letter 7

Newcastle University

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

Director General
National Environmental Standards Regulation and Enforcement Agency
Abuja
Nigeria

Dear Sir

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

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If you have any queries, please contact me.

Yours faithfully

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Appendix 10: Introduction letter 8

Newcastle University

School of Architecture, Planning
and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

Managing Director
Pipelines Products Marketing Company
Nigeria National Petroleum Corporation
Abuja
Nigeria

Dear Sir

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

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If you have any queries, please contact me.

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Appendix 11: Introduction letter 9

Newcastle University

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United kingdom

09 February 2009

Commissioner Force CID
Nigerian Police Force
Abuja
Nigeria

Dear Sir

Mr Unite Simon Ekwo

I am the joint academic supervisor of Mr Ekwo who has been registered as a full time PhD student within the School of Architecture, Planning and Landscape at Newcastle University since September 2007. He is due to complete in September 2011. He is researching into the use of satellite technology for the management of the rights of way of petroleum pipeline in Nigeria.

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If you have any queries, please contact me.

Yours faithfully

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Appendix 12: Introduction letter 10

Newcastle University

School of Architecture, Planning and Landscape

Claremont Tower
Claremont Road
Newcastle upon Tyne
NE1 7RU United Kingdom

6th October, 2010

The Executive Secretary

Petroleum Technology Development Fund

Abuja Nigeria

Dear Sir,

UNITE EKWO; ATTENDANCE OF A CONFERENCE IN THE USA

I write in support of Unite Simon Ekwo's application for funding to enable him to attend the EUEC 2011 Conference in Pheonix, Arizona, for which an abstract of his paper entitled "Collaboration-Based Management of Petroleum Pipeline Rights of Way in Nigeria" has been accepted.

The conference is the largest Energy and Environment conference in the United States of America and offers a unique opportunity for Unite to present his doctoral research work to a global academic audience.

I trust you will support him in this potentially productive endeavour. Please do not hesitate to contact me if you need further information.

Yours faithfully

A Graham Tipple BA, MA, PhD, MRTPI

Dissertation Supervisor

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Appendix 13: Acceptance of abstract for conference

EUEC 2011
JAN 31 – FEB 2
PHOENIX CONVENTION CENTER
PHOENIX, AZ

U.S.A.'s LARGEST ENERGY & ENVIRONMENT CONFERENCE
Phoenix Convention Center, 100 North 3rd Street, Phoenix, AZ 85004

Clean Air
Mercury
Global Warming
Renewable Energy

EUEC
2011

Jan 31 - Feb 2
Phoenix, AZ

Directors

energy.gov

Mitchell Baer
202/586-5167

EDISON ELECTRIC
INSTITUTE
John Kinsman
202/508-5711

EPRI ELECTRIC POWER
RESEARCH INSTITUTE
Ron Wyzga
650/855-2577

CARBON
TRADE
Prabhu Dayal
520/615-3535

"The 14th premier annual conference and trade show in North America, with 2,300 delegates, 900 companies, 700 technical presentations to facilitate information exchange and foster cooperation between industry, government, regulators, academia and stakeholders for the protection of our environment."

www.euec.com
EUEC
P.O. Box 66076
Tucson, AZ 85728

October 18, 2010

Mr. Unite S Ekwo
Newcastle University
School of Architecture Planning and Landscape
Newcastle Upon Tyne
Northumberland NE1 7RU
United Kingdom

Certificate of Acceptance to Make Presentation at EUEC 2011: Jan. 31 – Feb. 2, Phoenix Convention Center, Phoenix, Arizona.

We are pleased to provide this Certificate of Acceptance for Unite Ekwo who will be making a presentation titled: "Collaboration-Based Management of Petroleum Pipeline Rights of way in Nigeria" in the Sustainability Session at the 14th Annual Energy & Environment Conference & Expo (EUEC 2011) on Clean Air, Mercury, Global Warming and Renewable Energy, January 31 – February 2, 2011, at the Phoenix Convention Center, 100 North 3rd Street, Phoenix, Arizona, USA.

The EUEC is an annual conference held every January since 1995 in Arizona. It is organized and sponsored jointly by US Department of Energy, US Environmental Protection Agency, Electric Power Research Institute, Edison Electric Institute, and C Trade.

- Over 2,000 delegates attended EUEC 2010.
- Over 650 technical presentations are made at this conference in twelve concurrent tracks on Clean Air, Mercury, Global Warming, Renewable Energy and the Environment.
- EUEC has gained recognition and credibility as one of the best and largest energy and environment conferences of its kind in North America.
- Please see last year's program and conference information on our website at www.euec.com and click on "Program".

Please do not hesitate to contact me if you have any questions or would like more details. My email address is pdayal@euec.com   I am the Chairman for the EUEC Conference and President of CTRADE USA. Thanking you, with kind regards.

Sincerely,

Dr. Prabhu Dayal, P.E.,
Chair, Energy & Environment Conference (www.euec.com)
President, CTRADE (www.ctrade.org)
P.O. Box 66076, Tucson, AZ 85728
Phone: 520-615-3535 Fax: 602-296-0199, email: pdayal@euec.com

Appendix 14: Certificate of conference attendance

14th Annual Conference Jan 31-Feb 2, 2011
Phoenix Convention Center, 100 N. 3rd St.
Phoenix, AZ 85004

February 22, 2011

Certificate of Attendance

EUEC 2011: Energy, Utility & Environment Conference
Phoenix Convention Center, Phoenix, Arizona.
January 31 – February 2, 2011

We are pleased to provide this Certificate of Attendance for Unite Ekwo who participated in the 14th Annual Energy Utility & Environmental Conference & Expo (EUEC 2011) held Jan 31 to Feb 2, 2011, at the Phoenix Convention Center, 100 North 3rd Street, Phoenix, Arizona.

The EUEC is an annual conference held every January since 1995 in Arizona. It is organized jointly by the US Department of Energy, US Environmental Protection Agency, Electric Power Research Institute, Edison Electric Institute and C Trade.

- 2,000 delegates attended EUEC 2011.
- Over 600 technical presentations were made at this conference in twelve concurrent tracks on Policy & Legislation; Clean Air & Electric Utilities; Mercury / Air Pollution Control; Energy & Climate Policy; Carbon Capture & Storage; Carbon Markets & Finance; Corporate GHG Strategies; Bio-fuels, Biomass & Biogas; Sustainability & Reliability; Energy Efficiency & Management; Renewable Energy and Environment & Alternate Energy.
- EUEC has gained recognition and credibility as one of the best and largest energy and environment conferences of its kind to attend in North America.
- Please see the program and conference information online at www.euec.com

Please do not hesitate to contact me if you have any questions or would like more details.

Sincerely,

Dr. Prabhu Dayal, P.E.,
Chair, EUEC, P.O. Box 66076, Tucson, AZ 85728
Phone: 520-615-3535
Fax: 602-296-0199
email: pdayal@euec.com

Sidebar

EUEC 2011
Jan 31—Feb 2
Phoenix, AZ

Directors
energy.gov
Mitchell Baer
202/586-4653

EPA
Larry Kertcher
202/564-9121

EDISON ELECTRIC INSTITUTE
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"The 14th premier annual conference and trade show in North America, with 2000 delegates, 900 companies, 600 technical presentations to facilitate information exchange and foster cooperation between industry, government, regulators, academia and stake-holders for the protection of our environment."

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