

**DIFFUSION AND ADOPTION OF INFORMATION AND
COMMUNICATION TECHNOLOGIES IN THE MANAGEMENT
OF THE NIGERIAN NATIONAL PETROLEUM CORPORATION
AND ITS SUBSIDIARIES**

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**DEPARTMENT OF MANAGEMENT,
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UNIVERSITY OF NIGERIA,
ENUGU CAMPUS**

APRIL, 2009

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**BEING THESIS SUBMITTED IN PARTIAL FULFILMENT OF
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APRIL, 2009

CERTIFICATION

Ozigbo, Nathaniel Chizoba, a postgraduate student of the Department of Management with Registration Number PG/Ph.D/04/38117, has satisfactorily completed the requirements of course work and Research for the Degree of Doctor of Philosophy (Ph.D) in Management.

The work embodied in this Thesis is original and has not been submitted in part or full for any other Degree or diploma of this or any other university.

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APPROVAL PAGE

We, the undersigned certify that this thesis is adequate in scope and quality for the award of Doctor of Philosophy (Ph.D) in Management

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DATE

DEDICATION

This Thesis is dedicated to my entire family

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ABSTRACT

This study aimed at investigating the need for the diffusion and adoption of Information and Communication Technologies (ICTs) in the management of Nigerian National Petroleum Corporation (NNPC) and its subsidiaries, with particular references to the four refineries. In seeking solutions to the problem raised, four, research questions were formulated. The study described how the theories of diffusion and adoption have been used in the field of information and communication technologies. The study brought to the fore critical issues relating to the ICTs prevailing in the NNPC and its subsidiaries. The study was not a comparative one, rather aimed at identifying common factors affecting the decisions to acquire external technology. The study identified that the existing refineries have produced below capacity caused by poor management. The study took a cross investigation of the structure of the downstream sector and highlighted investment opportunities in refining, marketing and petrochemicals. The study was conducted through survey, and archival studies were carried out to identify some of the technical changes and technological capabilities of NNPC and its subsidiaries. The archival studies concentrated on annual reports, audited accounts, engineering reports, memoranda and statistics of NNPC and its subsidiaries. Data used in this study was collected from primary sources through structured questionnaire and interviews with the users of ICT components. In all, 400 copies of questionnaire were distributed to the respondents and a response rate of 96.50 percent was obtained. The data collected were analyzed using Analysis of Variance (ANOVA) technique and chi-square for the test of hypotheses. Also a multivariate probity regression analysis was adopted for testing hypothesis four. The study provided empirical evidence that the adoption of ICTs in the NNPC and its subsidiaries were beneficial. The study concluded that the future of NNPC and its subsidiaries were perceived to be dependent on the development and the upgrading of technological capabilities. The study made modest recommendations, that appropriate laws should be enacted to protect Nigerian National Petroleum Corporation and its subsidiaries from Foreign competitors and that obsolete equipment for training should be scrapped.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

When oil was discovered in Nigeria, the country had very little human resources to manage and operate a sizeable modern petroleum sector. The Foreign Oil Companies and the Government played major roles in establishing the prerequisites for the establishment of linkages and minor change capabilities especially in developing human resources for the petroleum industry. At the onset, the oil companies supported the establishment of departments and appropriate curricula for the training of Nigerians on oil related technological, science and engineering disciplines in Nigerian universities. Scholarships were awarded in significant numbers for overseas study. Assistance was given for relevant programmes for training in technical schools. This was also extended to in-house training programmes within the oil companies. The government's effort to alleviate the shortage of technicians led to the creation of Industrial Training Fund (ITF) to promote and encourage

the acquisitions of skills in the industry. Since the creation of ITF, encouragement was given to broad industrial training efforts to company manpower plans.

Against this backdrop, the researcher considered it necessary to investigate the diffusion and adoption of Information and Communication Technologies (ICTs) in the management of the Nigerian National Petroleum Corporation (NNPC) and its subsidiaries. The advent of Information and Communication Technologies had a huge impact on the way organizations of all types and users did their work (Kuuti, 1996:177-178). What has become known as the Information and Communication Technologies (ICTs) revolution has improved efficiency and effectiveness in most sectors of the economy (OECD, 2002:30). By allowing organizations to create and analyze important new information, it changed the way major decisions were made (Rochelean, 1999:23-36). In both business and government, the growth of the internet and its related software has spawned new ways of conducting business developments in ICTs and has changed the way economic activities were organized. The impact could be traced in two ways. First, how the ICTs industry changed during the last few years and second, how ICTs have impacted on other economic activities such as manufacturing and services.

The beginning of the ICTs industry is traced to the birth of the internet in the late 1960s and the appearance of the Personal Computer (PC) in the 1970s (Adubifa, 1990: 24). Its development as currently understood actually picked up momentum in the early 1990s. Since then, ICTs have integrated computing, communications and graphics through digitalization. It thrived on websites with the use of broad-band optical fiber lines. It has already made headway into the wireless mode and are becoming more and more personalized. ICTs are a general purpose technology and have wide applicability in various manufacturing and services sectors. It has the potential to affect virtually all sectors of the economy by imbuing greater information and development content in products and processes (Saidam, 2003:13). More importantly, it has spawned new products and made existing products more versatile. The development of ICTs has emerged to become another factor dividing the developed and the developing countries. ICTs have transformed the world, its potential for reducing poverty and fostering growth has increased rapidly.

The Nigerian National Petroleum Corporation (NNPC) and its subsidiaries are unique in Nigerian oil industry. Ogudu (1997:10) emphasizes that petroleum products have played vital role in the Nigerian economy and generated over 90 percent of Nigeria's Foreign

exchange earnings and 80 percent of federal government revenue. The NNPC and its subsidiaries have a long and chequered history, starting with mineralogical studies in 1903 by the Mineral Survey Company. In 1937, the forerunners of Shell Petroleum Development Company (SPDC) Shell D'Avey came to Nigeria and thereafter other oil firms followed. To ascertain the specialized information needs of the NNPC and its subsidiaries, maximum use of information and Communication Technologies became unavoidable.

It is known fact that Information and Communication Technologies have revolutionized the Information handling capabilities, especially in Information centers throughout the world, which resulted to massive investment in research aimed at making computer and telecommunication networks more efficient to cope with the increasing demands. All over the world, the development of science and technology has been recognized as a necessary condition for economic growth and social progress. In most developing countries, science and technology indicators have shown lower values than in other parts of developed countries (Wangwe, 2000:32). The relevance of coming to terms with the importance of science and technology at Nigeria's development cannot be overemphasized. Adubifa (1990:24-26) makes the point when he defined technology policy as a framework consciously put in place for the purpose of acquiring and utilizing scientific and technological knowledge in order to achieve national development objectives. The effective performance of this framework, according to Dahlman (1989: 13-15) requires enormous amount of financial, human and organizational or institutional capability. To develop these capabilities, a nation need to have the appropriate policy, build the necessary institutions and structures, which should be sustainable.

David (1992:215-216) explains the rationale for institutional networking for technological capacity building. In his own view, co-operation ought to exist between esoteric research for the purpose of expanding the frontiers of knowledge and research directed towards the production of goods and services. The trend towards institutional networking for the pursuit of technological knowledge has been furthered by the greater availability of standardized procedures embodied in new instruments for generating and analyzing data, as well as by the availability of high speed digital communication networks for linking spatially separated researchers (Mansell and Weh 1998:18-19). It is important to note that appropriate information technology and political stability are vital for the growth and vitality of any nation's economy. The presence of appropriate technology contributes to the operations of

organizations while the lack of it leads to poor performance of organizations. The lack of technology constrains the implementation of corporate strategies and policies.

In the eyes of many during long years that passed, the thought of Information and Communication Technologies in most part of the Nigerian economy was confined to traditional computer services and computer laboratories providing on most occasions, random and computer training that was not market based. For many, the establishment of such laboratories was the closest one got to Information Communication Technologies (ICTs), especially in the Non-Government Organization (NGO) sector. These days the very people who shared the traditional thoughts are thinking differently. Most are now convinced that ICTs without results are waste of time. Technology diffusion involves the dissemination of technical information and know-how and the subsequent adoption of new technologies and techniques by users (Tasse, 1992: 46-47). It focuses on reaching the entire society in accordance with its needs or in accordance with what technology could do to facilitate better results for the different sectors, resulting in collective economic growth and prosperity. The thoughts of Information and Communication Technologies diffusion were designed to lead to an elimination of the idea that ICTs are tools of the privileged and the favoured. A slogan such as "ICTs for all" is becoming a reality. Farmers, carpenters, doctors, engineers, managers and the society at large are required to make use of ICTs for their domestic and professional needs. A human development report (UNDP, 2003:65-67) identifies the needs to make available the benefits of new technologies, especially Information and Communication Technologies (ICTs) as one of the global goals to alleviate poverty.

1.2 STATEMENT OF THE PROBLEM

The thrust of this study is on the nature and magnitude of the diffusion and adoption of information and communication technologies in the management of the Nigerian National Petroleum Corporation and its subsidiaries. It is increasingly recognized that the development, adoption and diffusion of ICTs are key determinants to success or failure in the management of NNPC and its subsidiaries. In the transfer of technology, there exists divergence of interest between the host country, government and the foreign oil companies. The divergence of interest was borne in mind when contractual clauses pertaining to transfer of technology were negotiated or when they were being monitored during implementation. The product of this divergence of interest led to the emergence of aberrations of what was regarded as transfer of technology. In essence, the ability of any country to acquire oil technology depends on the degree of its openness to the inflow of foreign technology, and the training tailored to meet the specific technological needs of the NNPC and its

subsidiaries. It would be pertinent to find out if NNPC and its subsidiaries are capable of developing technologically in its operational activities in the context of the policies and institutional arrangements that have assisted the advanced countries to achieve technological capability in the management of the oil industry.

1.3 OBJECTIVES OF THE STUDY

This study shall attempt to investigate the nature of the diffusion and adoption of Information and Communication Technologies in the management of Nigerian National Petroleum Corporation and its subsidiaries. In this study, various policies designed to encourage the spread of Information and Communication Technologies will come under focus. To this end the following objectives shall be pursued.

- 1) To examine the core capabilities in NNPC production, investment, linkages and strategic marketing to see if they encourage ICTs adoption.
- 2) To study the impact of technical change and government economic policy on the performance and capacity of NNPC to acquire, develop and upgrade these technologies.
- 3) To investigate the need for strong, and dynamic technological adoption in achieving economies of scale and mass production.
- 4) To examine whether the telecommunication services in the NNPC and its Subsidiaries are effective as growth and productivity instruments.

1.4 RESEARCH QUESTIONS

In view of the above highlighted issues in the objectives of study, the following research questions were raised for purposes of guiding this study:

1. Do the core capabilities in NNPC and its subsidiaries on production, investment and strategic marketing encourage the adoption of ICTs?
2. To what extent do technical change and government economic policy affect the performance of NNPC to acquire, develop and upgrade these technologies?
3. To what extent is there the need for strong and dynamic technological adoption in achieving economies of scale in the operation of NNPC and its Subsidiaries?
4. To what extent are telecommunication services in NNPC and its Subsidiaries effective as growth and productivity instruments?

1.5 RESEARCH HYPOTHESES

In the course of this study, the following hypotheses were tested:

1. Ho: The core capabilities in NNPC and its subsidiaries on production, investment, and strategic marketing do not encourage the adoption of Information and Communication Technologies.
H_A: The core capabilities in NNPC and its subsidiaries on production, investment, and strategic marketing encourage the adoption of Information and Communication Technologies.
2. Ho: Technical change and government economic policy do not impact heavily on the performance of the NNPC and its Subsidiaries.
H_A: Technical change and government economic policy impact heavily on the performance of the NNPC and its Subsidiaries.
3. Ho: Strong and dynamic technological adoption does not facilitate the achievement of economies of scale in the operations of the NNPC and its Subsidiaries.
H_A: Strong and dynamic technological adoption facilitates the achievement of economies of scale in the operations of the NNPC and its Subsidiaries.
4. Ho: Telecommunication services in the NNPC and its subsidiaries are not effective as growth and productivity instruments.
H_A: Telecommunications services in the NNPC and its subsidiaries are effective as growth and productivity instruments.

1.6 SIGNIFICANCE OF THE STUDY

The significance of this study cannot be overemphasized, when one considers the resultant effects of inadequate access of information and communication technologies in NNPC and its subsidiaries. The study will help to put the theory of diffusion and adoption of ICTs into practical application. This process will help to verify the claims of the theory and consequently come out with the strengths and weaknesses of the theory. This study has broken a ground in academics, thereby closing a gap in academic literature and as such a major contribution to knowledge. This study is also significant because it will create the much needed awareness of diffusion and adoption principles as a management concepts that NNPC and its subsidiaries should embrace in order to improve the quality of their services. The study is also important for encouraging the spirit of the adoption of new approaches such as ICTs diffusion that undoubtedly provide long-term benefits and enhance local prospects and development.

The outcome of this study will serve as a blue print for policy-makers and stakeholders to chart the right course of action on the development of ICTs facilities and infrastructure in the NNPC and its subsidiaries. In addition, the study is expected to provide the basis for comprehensive information on the process of acquisition, availability and use of ICTs gadgets in the NNPC and its subsidiaries.

1.7 SCOPE OF THE STUDY

The study focused on Information and Communication Technologies (ICTs) diffusion and adoption in the NNPC and its subsidiaries. The subsidiaries used in this study consist of four refineries located at Port-Harcourt 1 and II, Warri Refinery and Kaduna Refinery. The scope of this study opened several discussions for further investigations.

1.8 LIMITATIONS OF THE STUDY

As one would expect, a research work of this nature involves numerous limitations. These limitations hampered the researcher's effort to have an in-depth study of the subject matter and come out with far-reaching findings. Some of these limitations include:

1.8.1 Time Constraints

Time was really a big constraint in carrying out this research study. The researcher had to combine the collection of materials for the study with other academic activities. The study was not easy to carry out due to trips to distant part of the country and the huge financial burden involved.

1.8.2 Prejudice

This formed another major handicap for the researcher. There occurred a general apathy on some of the respondents which were either as a result of fear of being reprimanded by higher management or as a result of underlined "Nigerian mentality", on the mere mention of the word research. This indisposition to the researchers was manifested in their unwillingness to give required information or deliberate giving of incomplete and misleading information. The hoarding of information was also on security ground. To the respondents, the researcher was yet another nuisance.

1.8.3 Financial Constraints

Financial limitations made the researcher to confine the research study only with NNPC and its subsidiaries. The cost involved in the collection of materials for the study was so enormous that the researcher sought for funding, especially from the University of Abuja.

These limitations notwithstanding, satisfactory efforts were made to ensure that the study was carried out under conditions that ensured scientifically valid conclusions.

1.9 DEFINITION OF TERMS

As a starting point in the study, the definition of certain terms is important in order to avoid possible conceptual confusion. This is important because terms like technology knowledge and social capability and others, which the researcher used in the present discourse, have their technical exactness within the context.

Technology: The term technology as used does not imply just machine. Dahlman (1989:13-15) definition which was adopted refers to technology by people and/or institutions which enable them to convert available inputs into desired outputs at maximum efficiency level.

Technological Capacity Building: This refer to the dynamic and progressive process in which, human and institutional capability is developed and sustained by organizations, communities and nations in order to benefit from economic interconnection within the global system.

Knowledge: Knowledge is a general term used as the opposite of ignorance about science and technology and their application is to the production and distribution of goods and services. Knowledge is critical to progress and development. Lack of it mean the lack of capacity to even access existing knowledge available.

Technological Knowledge: This simply mean know-how. Those countries, which possess less of it are caught in the poverty bracket (World Bank, 1998).

Social Capability: By Social Capability is meant the level of general education and technical competence of the people.

Strategy: This refers to master plan, policy put in place to achieve long-term goals and objectives of an organization.

Management: This refers to the control and making of decisions in an organization. It is the process of dealing with people.

Organization: The activity of organizing a group of people, structure, material and financial resources, system in a tidy and efficient way for the purpose of achieving well defined goal and objectives.

Technological Strategy: This is the deployment of technology for competitive advantage with primary focus on the product line, the production process and competencies.

Process Technology: Process technology includes the technology required to process oil and gas and evacuate it to the terminus. Such process technologies include those used in inflow stations, multi-phase pumps, floating product storage and off-loading.

Information Technology (IT): This is the acquisition, processing, storage and dissemination of information and data by means of computers and telecommunications.

Acquisition: This is applied in place of technology transfer. It refers to all the stages from buying, introduction, applying, adopting, adapting, localizing, and developing through to diffusion.

Technology Transfer: This take place between two parties or individuals and explains only technical and financial issues and does not explain social and environmental aspect.

Diffusion: This refers to the stage in which a technology is selected or used by an individual or an organization. It also refers to the stage in which the technology spread to general use and application.

Internet Technology: This embody a number of technologies, namely, e-mail, database, chat rooms, information and education resources. The Internet exhibits many elements that constitute a culture or community, that is, language, symbols, rituals, interactions and other elements of communication.

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CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

This chapter discusses the level of development and upgrading of the core technological capabilities in the Nigerian National Petroleum Corporation and its subsidiaries. The study examines the nature of technological capabilities and the effects of government policy on technological capability building. The study also evaluate the strategy and efforts of training adopted by the Nigerian government as a way of transferring the acquisition of oil technology, and the impact of technical change on the production and financial performance of the NNPC and its subsidiaries.

2.2 CONCEPTUAL FRAMEWORK

In the emerging electronics complex, Information Communication Technologies (ICTs) formed part of a constellation of industries, which consist of various sub-groups such as

semi-conductors, computers, components, telecommunications consumer electronics and office devices. Expectedly, the developments in the ICTs have persuasive impact on the role and direction of technological change not only in that sector, but across virtually all sectors. In the process, it brought about pervasive techno-economic and social changes. The growing applications of media electronics, optical fibres and digital networks are generic technological innovations tends to alter the fundamental nature of products and processes.

The revolution in Information and Communication Technologies (ICTs) in recent years, aptly captured by the establishment and access to a global networking of information systems have positively influenced time and space in the sending and receiving of information both within and across diverse organizations and also among diverse countries and regions (Deeson, 1987:9). This development has brought about drastic changes in the way in which decisions are reached and policies implemented. The diffusion of Information and Communication Technologies (ICTs) innovations embodied in a vastly improved computing and telecommunications capacity is generally weak in Nigeria. A strong interest in its adoption to provide information services have emerged for two main reasons (Aiyepoku, 1992:21-22). First, the revolution in ICTs has resulted in computer hardware becoming cheaper and more widely available. Secondly, the substantial utility (value added) of ICTs in the provision of and access to information services for improved planning and management have become more widely organized.

In Nigeria, technology diffusion is a multi-stage process, which commence with acquisition of the technology, the installation, utilization and assimilation of the technology. The assimilation process is the most crucial because it involves adaptations to the local environment. In the past several decades, the failure experienced by many developing countries including Nigeria which have imported foreign technology worth

billions of dollars, have been traceable to failure in the assimilation process (Deeson, 1987: 25-26).

The framework for this study was premised on the prevailing environment in Nigeria organizations, especially the NNPC and its subsidiaries. The study adopted the firm level technological capabilities framework defined in Ernest, Mytelka and Ganiastsos (1994) and applied in Gee and Kuo (1994: 16-15) Wie and Pangesty (1940: 20) and Paaponsakron and Tonguthal (1994:34-35). The definition of technological capabilities was based on the concepts of technological learning. Technological learning comprises of formal, non-formal and informal learning. Formal learning is defined as a planned degree and evaluated sequential characterized by on-the-job training and professional development. Informal learning is defined as a life-long process by which people who work in foreign affiliates or in domestic companies, which closely interact with transnational corporations acquire values, attitudes, and beliefs embedded in the organizational culture of transnational corporations through daily experience, observations and exposure to indoctrination.

Technological learning involves the challenges of acquiring technological knowledge. Generally, it is argued that two main components of technological knowledge that industry need to acquire and absorb are the public and tacit knowledge elements of technology. The public knowledge component includes such items as engineering blue prints and designs and the underlying genesis of scientific knowledge. It also includes management manuals, handbooks describing system features, performance requirements, material specifications and quality assurance criteria and the organizational methods and routines. Tacit knowledge is derived from and tied to the localized and collective learning experience of a given company through technological capabilities. The technological capabilities are into six categories (Dunn, 1987:10) namely:

- Production capabilities
- Investment Capabilities

- Minor change capabilities
- Strategic capabilities
- Linkage capabilities
- Major change capabilities

2.2.1 Production Capabilities: Include the knowledge and skills used in plant operation, where shop floor experience and learning-by-doing continue to play an important role despite the growing science and intensity of industrial manufacturing. Three broad types of activities are included in this category. They are production management and engineering and repair and maintenance of physical capital. The first involves organization /control of the production process, interaction with upstream/downstream and ancillary activities. Production engineering includes raw materials, production scheduling, quality control, repair and maintenance of production equipment influence the production process (Dosi, 1988: 41-44).

2.2.2 Investment Capabilities: This refers to the knowledge and skills utilized in the identification, preparation, design, and establishment and commissioning of a new industrial project, on the expansion or modernization of existing ones. This includes pre-investment capabilities and project execution capabilities. Pre-investment capabilities include all activities prior to and including feasibility studies, site selection and the scheduling of investment to the search for sources of technology, negotiation of contracts, scheduling of investment and bargaining for suitably transfer conditions.

2.2.3 Minor Change Capability: This is a firm's ability to improve and adopt continuously its products and processes. It covers adoptive engineering, organizational adjustments involved in the more mental upgrading of product design, performance feature and process technology.

2.2.4 Strategic Marketing: This consists of knowledge and skills required for collective market intelligence, the development of new markets for the establishment of distribution channels and the provision of customer services.

2.2.5 Linkages Capabilities: These involve the knowledge, skills and organizational competence associated with the transfer of technology. These levels are from one enterprise to another between the firm and the domestic scene and technology infrastructure. Within a firm, linkage capabilities refer to the capacity to manage interaction and informing sharing among divisions and business functions, such as research and development, design, engineering, procurement, production, marketing, sales and customer services. Linkage with the country's science and technology infrastructures relate to a firm's capability to attract, absorb and upgrade the available pool of human resources and to screen and scan new technology development and establish close integrations with applied and basic science (Dosi, 1988:41-44).

2.2.6 Major Change Capabilities: These involve the knowledge and skill required for the creation of new technology, that is major changes in the design and core features of products and production processes. Also include new product ideas, applied scientific knowledge and the ability to develop patents. Major change capabilities are derived from sources such as in-house research and development.

Besides identifying the formation of these capabilities, a fundamental argument is that technological capabilities are not free and easy to achieve. They are developed through conscious and sustained efforts by both industry and government. The essential pre-requisites for technological capability building according to Oladele (1999:21-23) include:

- The need to bring awareness to develop capabilities, willingness to do so and macro-economic stability.
- The incentive system or the combination of the array of government policy instruments will affect industry level innovation strategies directly or indirectly, market forces and historical practices.
- The broad strategies adopted by industries to develop technological capabilities and the various channels they have used to acquire technology.

There are at present four broad classes of new emerging technologies that are existing (Frenzel, 1996:10). These are information technology (IT) biotechnology, new materials and renewable energy technologies. Out of the four only one has experienced the most rapid development and taken the field of microelectronics, informatics, data processing and communication. All the emerging technologies shared certain generic characteristics, knowledge intensiveness or research and development (R&D) intensiveness. In order to promote a framework for assessment, a proper taxonomy is desirable. Dosi (1988:33-36) provides such taxonomy of technical innovations which include:

i. **Incremental Innovations:**

These occur continuously if the industry owes a long time and at different rates across innovations. They are often associated with plant scale-up, product and process adjustments. Quite often, incremental innovations remain largely unnoticed but their combined effects have dramatic effects on productivity growth.

i. **Radical Innovation:**

They are discontinuous events and are often as a result of deliberate Research and Development activities within firms and enterprises. When radical innovations occur, they provide the impulse for new markets.

iii. **Change in techno-economic paradigm (technology revolution)**

This lies at the heart of Schumpeter's theory of long waves. Technological revolution embodies many clusters of radical and incremental innovations and in time, may create several technology systems. They exert pervasive effect on the economy as a whole and bring about new technical and organizational modes. The introduction of the steam engine, electrical power and the electronic computer are typical examples considered together.

Frenzel (1996:15-16) regard Information Technology (IT) as both a range of product and services and as a technology which is capable of revolutionizing the process of production and delivery of all industries and services. Viewed in this manner, we have a framework which does not consider just the employment impact but captures the essential economic and social elements and consequences of Information Technology.

Evidently, the impact of IT necessarily is differentiated, depending on a whole range of macro-economic factors such as the overall macroeconomic and technological capability of a nation, the available skills and technological capabilities of the workforce, general literacy levels and the intervention capacity of the state to move decisively and effectively in determining the rate and direction of technical progress.

From this, we identify three kinds of technological capabilities and capacities pertinent to NNPC and its subsidiaries. These are innovation, production capabilities and network/service capabilities.

Innovation capabilities concern basic applied research and development, prototype design and production capabilities relate to design hardware and software, equipment manufacturing and testing. Network/service capabilities and capacities are resolved into network/service specification and purchase, installation, adaptation, maintenance and operation.

Information and Communication Technologies (ICTs) requires a certain level, a range of knowledge and intensive skills. An important and fundamental technical requirement for an efficient network/service growth is telecommunication infrastructure. Basic telecommunication facilities like the telephone remain a luxury for homes and business in most African countries.

In most part of the world today, Information and Communication Technologies (ICTs) have become major contributors to revolutionary change in business, commerce and daily living. Ironically, there are other parts of the world, especially those lacking the capacity to design, produce, and maintain ICT components that such impacts have been very minimal and in some cases non-existent. It is unfortunate that the enormous social and economic potentials of Nigeria, unlike other developing countries, Nigeria today is a heavy consumer of ICTs components without the capability to produce any. Table 2.1 below shows the acquisition of ICTs components from 1995-2000.

Table 2.1. Imports (Computers, Communication Equipments and others ICTs Peripherals (1995-2000)

S/N	Import	1995	1996	1997	1998	1999	2000
1.	Digital Computer	1,048,886	530,878	888,411	1,271,611	1,387,426	1,421,443
2.	Digital Central Storage Unit	26,294	32,531	42,445	107,055	114,690	126,421
3.	Potable Radio Receiver	187,311	630,730	949,578	2,099,259	549,575	506,976
4.	Line Telephone Equipment	1,368,853	5,156,939	2,640,145	6,551,305	10,194,919	2,605,024
5.	Television Radio Transmitter	617,385	1,087,992	1,961,101	1,592,600	1,156,149	486,583
6.	Radio, telephone	227,976	187,708	1,176,416	304,520	16,243,223	20,675,146

	Receiver						
7.	Telecommunication Equipment	2,481,752	4,841,321	5,421,683	6,448,004	29,452,817	3,963,311

Source: Nigeria Trade Summary, Federal Office of Statistics, Abuja 2002.

Production efforts in ICTs peripherals in Nigeria have been limited to assembly of consumer electronics household items such as television, radio, fridge and fans.

2.3 FRAMEWORK FOR UNDERSTANDING INFORMATION TECHNOLOGY DIFFUSION

A growing literature on Information Technology Diffusion suggested that there exist a vast potential for using ICTs to accelerate the process of economic development, provide greater opportunities to participate in global trade and production, provide better access to information, helps achieve and maintain international competitiveness, enable environmentally friendly development. One unprecedented opportunity that ICTs have opened to us includes access to global knowledge at an increasingly low cost. Even the most remote countries have now been connected to knowledge and data bank, helping them bridge the vast knowledge gap. The rapid spread of the internet worldwide is an example of changing information accessibility in all countries.

Technology diffusion involves the dissemination of technical information and know-how and the subsequent adoption (Tasse, 1992:47). It focuses on reaching the entire society in accordance with its needs or in accordance with what technology could do to facilitate better results for the different sectors, leading to collective economic growth and prosperity. The thought of ICTs diffusion was designed to lead to an elimination of the idea that ICTs was the tool of the privileged and the favoured. History records this decade as the electronic information age, where communications are instantaneous and global events are witnessed as they happen.

Technology, as indicated by Adeyinka (1996:8-9), is key to competitiveness and economic growth of all the many technologies of our time. Progress in Information and

Communication Technologies (ICTs) no doubt has the greatest influence on the global national economy. This makes it possible to process and transmit data at breathtaking speed and declining cost, thereby increasing productivity and improving quality and efficiency. The information revolution is currently sweeping through our economy. No company can escape its effects. Dramatic reductions in the cost of obtaining, processing and transmitting information are changing the way we do business. The information evolution affects competition in three vital ways (Warren, 1994:109),

1. It changes industry structure and in so doing alters the rules of competition.
2. It creates competitive advantages by giving companies new ways to outperform their rivals.
3. It spawns whole new business from and within a company's existence.

An important concept that highlights the role of Information Technology in Competition is the "value chain". This concept divides a company's activities into the technologically and economically distinct activities it performs to do business. We call these Value Activities. A business is profitable if the value it creates exceeds the cost of performing the value activities.

Information and Communication Technologies are permeating the value chain at every point, transforming the way value activities are performed and the nature of linkages among them. It does affect competitive scope and reshape the way products meet buyer's needs.

Porter (1985:98) emphasizes that every value activity consists both a physical and an information processing components. The physical components includes all the physical tasks required to perform the activity while the information processing components encompasses the steps required to capture, manipulate and channel the data necessary to

perform the activity. Every value activity creates and uses information of some kind. A logistics activity uses information like scheduling, transportation rates and production plans to ensure timely and cost effective delivery. A service activity uses information about service request to schedule calls and order parts and generates information on product features that a company uses to revise product designs and manufacturing methods. In essence, Information and Communication Technologies generates more data as company performs its activities. Such technologies made room for a more comprehensive analysis.

Information and Communication Technologies are transforming the physical processing component of activities through new information flow. It enhances company's ability to exploit linkages between activities, both within and outside the company.

Chandler (1977:86) states that the new technology has a powerful effect on competitive scope, creates many new interrelationships among businesses and expand the scope of industries in which a company compete to achieve competitive advantage. Information and Communication Technologies not only transform products and processes, but also the nature of competition itself. In playing a direct role in cost, ICTs alters the cost drivers of activities in way that improve or erode a company's opportunities to take advantage of a new competitive scope.

Warren (1994:109) indicates that it is very likely that ICTs play a strategic role in an industry that is characterized by one or more of the following features:

- Potentially high information intensity in the value chain, a large number of suppliers or customer with whom the company deals directly. A product requiring a large quantity of information, a product line with many distinct product varieties.

- Potentially high information intensity in a product, that provides information; a product whose operation involves substantial processing requires the buyer to process information.

The importance of information evolution is not in dispute. The question is not whether ICTs have a significant impact on a company's competitive position, rather the question is when and how this impact strike companies that anticipate the power of Information and Communication Technologies. A growing literature on Information and Communication Technologies diffusion suggested that ICTs provided windows of opportunity to the developing countries to break out of a vicious circle of economic and technological dependency. What has become clear is that the efficient deployment of ICTs may soon be indispensable for achieving international competitiveness in an increasingly integrated, information global economy.

Other studies of ICTs diffusion (UNESCO, 1997) indicated that the use resulted in significant increases in operational efficiency. The studies argue that even at low wage levels, automation could make economic sense provided certain organizational prerequisites are in place. The studies emphasized that ICTs adoption involved a substantial learning process, and major institutional and skill changes and a relatively long gestation period before dramatic improvements could be realized.

A number of barriers appear to impede the diffusion of ICTs. One of the key impediment is the lack of awareness of the potential benefits.. This is particularly true of small and medium sized enterprises and low tech traditional sectors. Perhaps a more crucial barrier to diffusion is an organization's capacity to absorb a new technology. Effective use of ICTs involved much more than the introduction of hardware and software. The successful absorption of ICTs required technical capabilities, good managerial skills and entrepreneurship capabilities.

2.3.1 Phases of Information Technology Diffusion

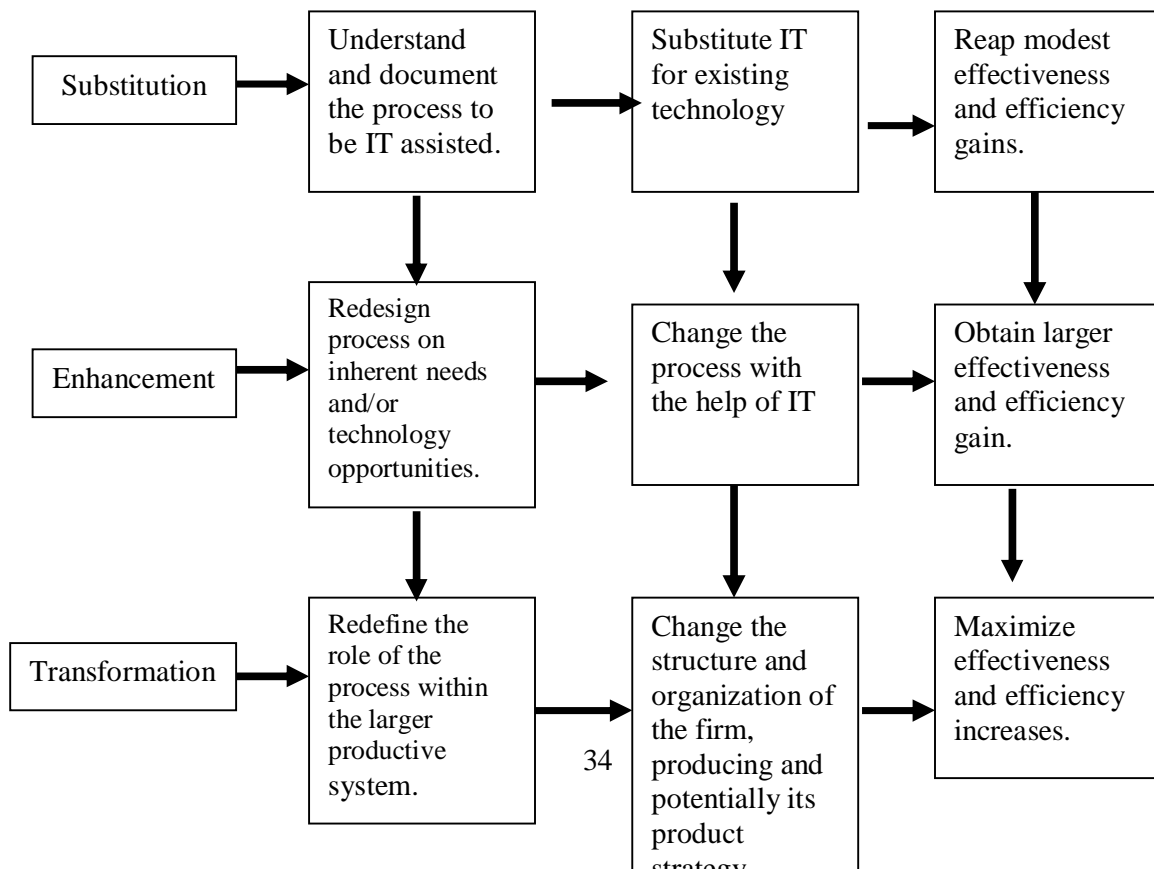
- This section of the study focuses on different phases of Information Technology diffusion. It covers a vast range of technologies from Management Information System (MIS) that attempts to utilize the growing flow of information as a useful resource for management and co-ordination to Advanced Manufacturing Technologies (AMT) that are used to cope with the growing information content of the processes on the shop floor.

The empirically-based literature-dealing with technology diffusion made it abundantly clear that technology acquisition involve a great deal more than simply buying black boxes and setting them to work.

This section of the study discusses three diffusion phases and associated modes of technological usage as shown below:

- substitution phase
- enhancement phase
- transformation phase

IT DIFUSSION PHASES



Source: OCED, Adopted, 2003

i. Substitution

Substitution involves simple replacement of existing technology with Information Technology. The usual expectation is that new technology performing the old function will improve productivity, though this is not always the case.

ii. Enhancement

This involves redesigning an existing process to make the best use of the new technology, improve product quality and provides additional and related services.

iii. Transformation

Transformation involves taking a system perspective on the roles of the process within the organization as a whole. As a result, the process may be merged with another, eliminated or expanded.

The existence of different diffusions phases or levels of ICTs use have implications for government policy formulation as follows:

- Since the barriers to take-up vary in each diffusion phase, policies to spread ICTs have to be based on a sound analysis of the barriers characteristic of each phase.
- They are unlikely to be any rapid improvement in aggregate productivity across economies as long as the major thrust of diffusion is to involve first generation users in the substitute phase.
- Transformation benefits are likely to remain particularly difficult to achieve without strategies to help lower internal organizational barriers to

structural overhaul and complementary policies to improve the infrastructures within which firms operate.

Technology diffusion is about users not technology. Users' need should be carefully researched before diffusion programmes are put into place, and policy actions should be aligned to user business priorities. Diffusion programmes work by improving the rationality of business processes, a point sometimes overlooked in programme design.

The reality of diffusion of new technologies are far from the Neo-classical view of technology transfer, which assumes that technology is readily transferable between organizations or countries, and that such transfer can be readily effected through the market. The Nigerian government views information technology as a key technology and therefore developed policies to promote its diffusion in private industries and public services.

Information and Communication Technologies diffusion involves more than acquiring computerized equipment and micro-electronic based product. It involves the development of technical change and to adapt given technology to a widening range of needs.

This study is of the opinion that Information and Communication Technologies generation and diffusion should continue to be driven by the private sector, government's role should be re-oriented to expand private sector choices, promote diffusion among lagging users and stimulate the development of a national information infrastructure. The government should focus on promoting standards, training and developing networks among IT users to share experience. In devising diffusion programme, the government should exploit and extend the capabilities of the private consulting industry to facilitate learning among users. Aid agencies should move beyond investing in ICTs components of development projects and assist government become effective in designing ICTs policies and strategies.. In addition, aid agencies should promote public-private

partnership and help develop private sector involvement in planning and implementing Information and Communication Technologies projects.

2.3.2 Determinants of Effective Diffusion Programme

This section of the study examines the determinants of effective ICTs diffusion. The study reviewed the experiences of developed countries as to draw lessons and trends. Information Communication Technologies are the most pervasive generic technology of our time. The developing countries including Nigeria are traditionally seen as passively engaged in the acquisition and use of technology generated in the industrial countries.

UNCTAD (1998:45) indicates that the pace direction, and extent of the diffusion of any technology, depends on a large extent on the nature of demand for improved product and better work practices. This was influenced by the overall incentive framework within which firms operate. In practice, a competitive market environment puts pressure on firms to improve productivity and the quality of their products and thus drive them to acquire new technology. The acquisition and use of a technology is not easy. It depends largely on the availability of appropriate skills, access to information and availability of appropriate financing mechanisms.

Adeyinka (1996:13-15) identified two major determinants for effective diffusion process;

- Human capital, and
- Research and Development.

Human Capital

The empirical literature dealing with technology diffusion shows that technology transfers involves a great deal more than simply buying black boxes and setting them to work. The acquisition of new technology requires the ability to evaluate various technological options, to search for reliable suppliers, procure appropriate configurations of tools and systems and enter into pertinent technical and marketing arrangements. It is usually not possible to transfer foreign technology without some modifications to suit

local conditions (climate, raw materials, scale of production, product quality, and design specification of buyers). Information and Communication Technologies needs special skills which are not readily available in most countries due to the novelty of this technology. The ICTs revolution imposes tremendous demand for education and training, necessitating a complete revamping of academic curricula to strengthen education in Mathematics, Management, Computer Science, Electronics Engineering and other engineering sciences.

Given its generic nature, users who invest in ICTs do not necessarily build on their own accumulated technological capital and may require external support to develop ICTs adoption capabilities (OECD, 2003:23). In such cases, public support programmes could help firms to develop the necessary adoption capabilities. It is becoming increasingly clear that skill shortages and changing skill requirements are the principal initial barriers to the introduction of new information technologies in both industrialized and industrializing countries. Surveys conducted in manufacturing industry in many OECD countries show that all have faced similar problems.

The majority of establishments in France, Germany and the United Kingdom rated lack of expertise as the most important problem when introducing micro-electronic into products and processes. In Australia, 78 percent of the firms surveyed in 2002 listed the need for higher qualifications and a different mixture of skills as a principal side effect of introducing new technology (OECD, 2003:25). In Italy, a survey of 30 enterprises adopting flexible automation technology found that they mainly lacked design capabilities and skilled machine operators and were hindered by problems related to production organization, programming and software acquisition (OECD, 2003:25). In Japan, over 70 percent of Japanese firms surveyed reported that difficulties in adaptation and changes in the substance of work were greater than in the past, and that the impact of ICTs were increasingly the importance of technicians and technical training (OECD,

2003:28). In addition to inadequate supply of technological skills, shortages of skills for market exploration, management and the integration of new technologies are also crucial. Skill shortages are not simply due to shortages and mismatches in the supply of new entrants to the labour market. Bottlenecks also occur because firms are slow to re-train workers, though many of the necessary ICTs skills can be developed through on-the-job training. Realizing this, and in addition to enhancing general education related to information Technology, many countries have launched policies and programmes specially designed to retain existing staff. In essence, a key determinant of ICTs diffusion programmes have been staff training programmes where courses were tailored to meet the needs of the organizations.

Research and Development (R&D)

Research is conventionally associated more with technology generation than diffusion, OECD (2003: 23) emphasizes that how firm-based R&D affects the speed of technology diffusion depends on:

- The degree to which knowledge in a particular field is cumulative:
- The degree to which it is targeted to the specific needs of the firm,

Realizing the above fact, government should provide a number of incentives to encourage firm level R&D ICTs as well as strong support to universities and the research system linked to them. These institutions provide the qualified personnel needed for an increasingly technological economy, the base for applied research and the national competence for participating in international R&D networks.

2.4 GROWTH OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN NIGERIA

It is on record that the electronic digital computer made its first appearance in Nigeria in about 1963. In the ten years between 1963 and 1973, the total computer population in the country stood at 20 ó 25, with 6 or so of these being associated with the multinational

companies. By 1977, the total number of installations had grown to around 70. It was by this time that many universities, government departments and parastatal organizations,, including the west Africa Examination council (WAEC), the Joint Admissions and Matriculation Board (JAMB), the National Electric Power Authority (NEPA), the Nigerian ports Authority (NPA) and the Federal Office of statistics, as well as many banks and commercial firms began to show interest in computers.

Up to 1977, there were only three computer vendors in Nigeria. They were JCL, IBM and NCR and all three were the local subsidiaries of overseas computer manufacturers dealing almost entirely with main and minicomputers. In 1977, the government promulgated the indigenization decree, which set apart some categories of industrial activity exclusively for participation by Nigerian nationals, while stipulating a minimum of Nigerian interest in others. One of the three original vendors, IBM, did not want to comply with the decree, choosing instead to pull out of the country.

The decree produced two other important effects; First there was an influx of indigenous vendors in the computer business. Secondly, the keener competition in the industry led to more installations, in the country rose sharply. Whereas 39 computers were installed between 1975 and 1977, 1978-1980 witnessed the addition of 197 new installations. There were 149 new installations in 1981-1983 and a further 99 in 1984-1986.

Table 2:2 below lists some important milestones on computer usage in Nigeria

Year	Event
1948	Visible record computer sold to Nigerian ports Authority by ICL
1949	NCR Incorporated
1961	IBM Incorporated
1963	Computer hired to assist in the processing of the national census data (operated by expatriates)
1963	IBM African education center set up at University college Ibadan
1972	Computer science courses instituted at University of Lagos, University of Ife and University of Ibadan
1973	Computers used in 1973 national census
1975	Computers science course instituted at more universities, including the University of Nigeria, Nsukka
1977	Indigenization decree promulgated
1978	Computer vendors Data Science, JKK, Data-matrix and Debis established
1981	Many more computer vendors established
1982	Banks begin to computerize
1982	Import licensing started
1983	First microcomputer exhibition at Lagos by Ogis and Ododo, 33 Vendors exhibited
1984	Anambra State Government Ministry of Finance placed order for locally manufactured microcomputers
1985	Committee of directors of Nigerian Universities computing center (CDNUCC) inaugural
1987	NNPC optical fibre computer communication network

Source: Federal Office Statistics, 1990

Table 2:3 Distribution of computer Installations by State, 1998

State	No of Installations	Percentage
Anambra	22	2.9
Bauchi	5	0.7
Bendel	24	3.1
Benue	3	0.4
Borno	2	0.3
Cross River	7	0.9
Gongola	4	0.5
Imo	13	1.7
Kaduna	30	3.9
Kano	17	2.2
Kwara	8	1.0
Lagos	550	71.7
Niger	1	0.1
Ogun	10	1.3
Ondo	12	1.6
Oyo	38	5.0
Plateau	5	0.7
Rivers	13	1.7
Sokoto	3	0.4

Source: Federal Office of Statistics, 2000

The position of the Lagos metropolis as the then political, commercial and industrial capital of Nigeria, as well as being the base of practical all computer vendors in Nigeria, easily explains its dominance in computer usage. Oyo, Kano, Kaduna and Bendel States, each with more than 2 percent of the installed computer capacity are also known to have a significant concentration of industries.

Table 2.4 The importation of digital computers by country of origin

Country	Value Kg	No	N'000
Japan	310,337	46,381	46,525.3
United states	35,895	699	15,057.6
United kingdom	18,444	468	4,395.2
France	2,089	202	46,1.0
Korea (South)	2,134	210	462.0
Italy	302	19	85.6
Australia	268	12	22.3
Hong Kong	106	2	11.4
Free Zone	38	1	3.8

Source: Federal Office of Statistics, 2002

The government from time to time took a stand on some specific Information technology issues. For example, in the late 1970s, the federal government set up a committee charged with the task of assembling, available natural data on computing. The committee was expected to develop standards for users, vendors and consultants on computer projects as well as to develop inputs for national policy on computing. As this was a period of import restrictions, the committee had the additional function of reviewing all applications for the importation of computers and making recommendations to the Ministry of Finance for the grant of import licenses. With the advent of import deregulation (one of the gains of SAP), the committee became moribund.

In 1986, an advisory panel set up to discuss micro electronics development in Nigeria made a number of far reaching recommendations, which include;

- A programme of short-terms activity directed towards the development, design and fabrication of prototypes of microprocessor based systems.
- The creation of activity centers for the implementation of the short- term plan
- The foundation of a Technology Development center.

- The formation of a National Committee on high technology microelectronics (Adubifa, 1990:34)

The recommendations came at a time when a National science fund was being set up and so funding seemed to have been assured. Two research institutes were developed, namely the Federal Institute of Industrial Research (FIIRO) at Lagos and the projects development Institute (PRODA) at Enugu. These two centres were expected to play an important role in ICTs developments.

2.5:1 Development of the Oil Industry

The history of oil exploration in Nigeria date back to 1908, when a German entity, the Nigerian Bitumen corporation commenced exploration activities in Araromi area of Ondo State, Nigeria. These pioneering efforts which ended abruptly with the outbreak of the first world war yielded some 16 shallow boreholes and confirmed a line of oil seepage in Eastern Dahomey basin in Okitipupa, oil prospecting efforts resumed in 1937, when Shell DøAvey (the forerunner of shell petroleum Development company of Nigeria) was awarded the sole concessionary rights covering the whole territory of Nigeria. Its activities were also interrupted by the Second World War, but resumed in 1947. Concerted effort after several years led to the first commercial discovery in 1956 at Olobiri, Bayelsa state. This discovery opened up the oil industry in 1961, bring in Mobil, Agip, ELF and Chevron/Texaco. Production of oil commercial quantity commenced in 1958 at 5,000 barrels per day (bpd) and reached 17,000 barrels per day in 1960. At that time, the multinational oil companies operating in the country bore the risk and cost of exploration, development, production and acquired title to all crude oil produced. They also paid rent, royalty and taxes from the operations.

Prior to 1963, the interest of the federal government in oil industry activities was handled on departmental basis by the hydrocarbon section, the department of petroleum resources and the Nigerian petroleum Refining company which were under the Federal ministry of

mines and power (FMMP). In 1971, shortly before the country joined the Organization of petroleum Exporting countries (OPEC), the Nigerian National Oil Corporation (NNOC) was established as a full-fledged national oil company with the responsibility for operating functions while the ministry took charge of regulatory functions. The corporation provided a platform for government to take up participating interest in the operations of multinational companies, which had dominated the business before now. In 1971, government exercised its option of taking 35 percent equity interest in Nigerian Agip Oil Company. In the same year, government again established her sovereign rights an acquired in safrap (now ELF). In 1974, government began acquiring participating interests in the operations of multinational oil companies in conformity with OPEC's mandate requiring member countries to take more active roles in the oil industry of their respective countries in order to facilitate the transfer of technology, skill and experience. Apparently, to consolidate its multi-dimensional role as well as streamline training requirement, the Nigerian National petroleum corporation (NNPC) was established on April, 1, 1997, under the statutory instrument Decree No. 33 of same year, by a merger of Nigerian national Oil Corporation (NNOC), with its operational functions and the federal Ministry of Mines and power with its regulatory responsibilities.

This decree established NNPC, a public organization that would on behalf of government, adequately manage all government interests in the Nigeria oil industry. In addition to its exploration activities, the corporation was given powers and operational interests in refining, petrochemicals and products transportation as well as marketing. Between 1978 and 1989, NNPC constructed refineries in Warri, Kaduna and Port Harcourt and over the 35,000 barrel Shell B.P established in Port Harcourt. The corporation constructed several kilometers of pipelines, pump stations and depots for distribution of petroleum products throughout the country and pioneered exploration activities in the Chad basin around Maidugiri. In 1982, product retail, which was firmly in the hands of major multinationals oil companies, was deregulated to accommodate

independent (indigenous) marketers. In 1990, with a view to improving the country's oil and gas reserve base, oil exploration which has progressively moved offshore Niger Delta was further extended into frontier areas including the deep offshore and the inland basins of Anambra, Benin (Dahomey) and Benue where acreages were allocated to several multinationals after signing a production sharing contract (PSC) with NNPC.

The same year, a reinvigorated indigenous operation programme was introduced through the allocation of blocks to indigenous companies, who operated on sole risk basis.

The production sharing contract (PSC) is today the toast of response to the funding problems faced by the Joint Venture (JV) arrangements between the NNPC and the participants in the inland deep and ultra deep-water acreages. Its main features include:

- The contractor bears all costs of exploration and production without such costs being reimbursable if no discovery is made in the acreage;
- Cost is recoverable with crude oil in the event of commercial discovery with provisions made for tax oil, cost oil, profit oil.

2.5:2 Nigerian National Petroleum Corporation (NNPC)

The formation of the Nigerian National petroleum corporation (NNPC) in 1997 was an off shoot of different developments in the country's oil industry. The evolution of the corporation was after the first commercial oil discovery made in 1956 by shell in Olobiri, (present day Bayelsa state). This was after about half a century of exploration activities in south Eastern Nigeria where the explorers made numerous bitumen seepage finds. NNPC was formed through the merger of the then Nigerian National oil Corporation (NNOC) and the Ministry of petroleum refining, petrochemical and products transportation as well as marketing. Currently, NNPC employs about 10,000 personnel. The new NNPC group comprises the group Managing Director's Office and the Directorates namely;

- Exploration and Production
- Finance and Accounts
- Corporate services

A group Executive director heads each of the Directorate. NNPC corporate vision is to be an integrated oil and Gas company engaged in adding value to the Nation's Hydrocarbon resources for the benefit of Nigerians and all stakeholders. Consistent with this vision, and as part of the transformation process, the corporation pursued the following objectives in the development of the downstream sector (NNPC Report 2002) which include:

- integrate refining and marketing functions;
- add value to hydrocarbons prior to sales
- improve refining capability at home and explore the development of offshore refining capacity
- establish international retail outlets and marine transportation infrastructure;
- increase the effective use of strategic partnership for international downstream investments;

The corporation has the following wholly-owned subsidiary companies:

- Duke Oil Limited
- Eleme Petrochemicals Company Limited (CPCL)
- Integrated Data Service Limited (IDSL)
- Kaduna Refining and petrochemicals company (NETCO)
- Nigerian Gas company Limited (NGC)
- Nigerian petroleum Development Company limited (NPDC)
- Pipelines and products marketing company Limited (PPMC)
- Port-Harcourt Refining and petrochemical company limited (PHRC)
- Warri Refining and Petrochemicals Company limited (WRPC).

2.5.3 Structure of NNPC and Its Subsidiaries

NNPC is saddled with enormous national economic and social responsibilities. The survival of the corporation therefore depend on nothing less than a proven ability and willingness of the workforce to discharge their responsibilities to the satisfaction of the

Nigerian government and people. This in turn is dependent on the availability of a good crop of well-trained, highly knowledgeable, skilled and motivated leaders. Under the present democratic governance, NNPC has been afforded the opportunity of regaining its statutory functions without undue interference. Government has demonstrated a sympathetic understanding of the problem(s) and needs and has been responding appropriately. The implication of this development for NNPC is to make the most of it by being more dedicated to their duties and living up to their responsibilities. To do otherwise will result in dire consequences. As it is commonly said, "To whom much is given, much is expected".

The New NNPC group comprises the Group Managing Directors Office, Four Directorates namely, Exploration and Production, Refineries and Petrochemical, Finance and Accounts and Corporate Services. Each of the Directorates is headed by a Group Executive Director. Its ten subsidiary companies, two partly owned subsidiaries and 16 associated companies manage the upstream and downstream activities of NNPC. Also, the National Petroleum Investment Management Services (NAPIMS) in the Exploration and Production Directorate monitors and supervises government investment in the joint ventures, Production Sharing Contracts (PSC) and other contract agreements in the upstream sector of the industry.

The NNPC has commenced a transitional process aimed at repositioning the corporation towards fully realizing its vision and mission. The process which has progress rapidly by the management involves amongst others, realignment and deregulation of its operations to allow private sector participation and transformation of its way of doing business.

Consistent with modern trends in global business and government policy of deregulation, and privatization, the corporation is opening up its operations to private sector investment. The intention is to provide its access to modern technology, opportunities for

alternative funding and new management systems which will help the process of re-engineering and re-focusing the corporation towards meeting set objectives (NNPC Report 2004). The Corporation has begun transformation process aimed at enhancing growth and cost effectiveness in its operations. It is aimed at ensuring NNPC is able to compete globally like other national oil companies. Old ways of doing business are to change to new and world class systems and international competitiveness and sustain profitability through expanding participation in the local and international oil and gas industry to be pursued. The transformation agenda was encapsulated, "PROJECT PACE", launched by the corporation and on which the entire workforce was sensitized. The corporation has made significant studies regarding the discharge of its responsibilities to the nation, a lot more still needs to be done to put it on yet a greater footing.

NNPC is today faced with the challenges for survival and relevance and in the current national development agenda and the global energy business. Privatization and deregulation which allow the private sector to play dominant roles in the domestic petroleum product supply and distribution business to promote transparency, efficiency, competition, accountability and professionalism compel NNPC to reposition itself for survival. Rising global oil and gas demand at a time of limited spare production capacity and geopolitical tension leading to high prices provide opportunity for investment in wider terrains and frontiers (Turner, 1982:14-16). The 2005-2007 NNPC strategic plan provided the framework for transforming the corporation to meet the challenges of the 21st century.

2.5.4 The Operations of the Refineries

Between 1978 and 1989, NNPC constructed refineries in Warri, Kaduna and Port-Harcourt and took over the 35,000 barrel shell refinery established in Port-Harcourt in 1965. (NNPC Report, 2004). The Corporation constructed several kilometers of

pipelines, pump stations and depots for distribution of petroleum products throughout the country and pioneered exploration activities in the Chad Basin around Maiduguri.

(i) Kaduna Refinery and Petrochemical Company:

The Refinery was commissioned in 1980 to supply petroleum products to Northern Nigeria with an initial capacity of 50,000b/d. In 1983, the capacity was expanded to 100,000b/d crude train dedicated to the production of lubricating oils (lubes). In 1986, the capacity of the first crude train was expanded to 60,000b/d. The expansions have increased the current nameplate capacity of the refinery to 110,000b/d.

The petrochemical unit consists of a production complex with a target of 91 tonnes per day of Linear Alkyl Benzene (LAB) which is the major feedstock for the production of detergents. It was commissioned in 1988 and uses UOP process technologies. The main refinery units and their capacities are shown in table 2:5 below.

Table 2.5 : Refinery Units

Process	Unit	Capacity
Crude, distillation, fuel	CDU ó 1	60,000b/d
Vaccum Distillation Fuels	VDU ó 1	15,200 b/d
Fluid Catalytic cracking	FCU	21,000 b/d
Naptha Hycho treating	NHU	24,000 b/d
Kerosene hydrotreating	KHT	17,500 b/d
Catalytic reforming	CRU	17,500b /d
Sulphur Recovery	SRU	10 Tonnes/day
Crude Distillation Lubes	CDU-2	50,000b/d
Propane deasphalting	PDU	7,860b/d
Furfural Extraction	FEU	12,450b/d
MEK Dewaxing	MDU	5,300 ó 9, 400
Wax Deoiling	WHU	75 Tonnes/day
Asphalt Blowing	ABU	6,000b/d
Linear Alkyl Benzene	LAB	91 tonnes/day

Source: NNPC Report 2002

The refinery has all the utilities (on site) required for its operation. The installed capacities of the utility plants are shown in table 2:6 below:

Table 2.6: Installed capacities

Utility	Capacity
Electricity ó stream turbines	4 x 4MW
Stream Boilers	5x120t/hre42bars
Raw Water Treatment	750m ³ /hr
Cooling Water	18,000 m ³ /hr
Demineralised Water	340m ³ /hr
Nitrogen	920 NM ³ /hr
Instrument Air	3 x 6000 NM ³ /hr
Waste water treatment plant	Annual N/A

Source: NNPC Annual Report, 2002

The refinery produces various yields of crude oil by products as shown below:

Table 2.7: Products out of KRPC 2000 – 2004

Products	2000	2001	2002	2003	2004
LPG	930	1	60	1617	165
PMS	21,4170	242810	332100	438275	136341
HHK	193840	150260	213020	232612	75123
AGO	195180	237910	353730	400447	115828
LPFO	386750	416540	650510	533800	82055

Source: NNPC Report 2005

The refinery has a capacity of 110,000b/d. However, since 1983, it has never achieved full throughput and production has declined. The throughput for the refinery in 2002 was about 40,000 b/d as against the nameplate capacity of 110,000 b/d, which translates to about 36% capacity utilization.

The inefficient operation of the refinery could be attributed to these main issues listed below solving of which would ensure that the refinery could be run at an optimum capacity (NNPC Report 2005).

- Crude oil is being supplied by pipeline from the Escravos terminal which is located along the volatile Niger Delta area.

- Refurbishing of the existing utilities of the plant so that they would perform at optimum and meet all the operational requirements of the refinery.

(ii) **Port-Harcourt Refinery Company Limited (PHRC)**

The Refinery complex comprises two refineries at Alesa-Elеме near Port-Harcourt in Rivers state. Port-Harcourt II (New Refinery) is a complex, conversion refinery with a nameplate distillation capacity of 7,500,00MTA (150,000 bpd). It came on stream in 1988 and was originally intended to serve as an export refinery. It has been subsequently dedicated to domestic market services, given frequent interruptions in supply from the other three refineries in Nigeria.

Port Harcourt II has considerable clean fuel capability, including lead-free gasoline,. The capacity has an authorized share capital of N5million, divided into 5 million ordinary shares of N1 each. The two refineries have two main facilities respectively, the main processing units and the utilities and tank farms as shown in table 2:8.

Table 2.8: Processing units

Old Refinery (PH1)	Unit	Capacity
Crude distillation CDU	-	60,000 b/d
LPG Unit	LPGU	60 b/d
Catalytic Reforming	CRU	6,000 b/d
New Refinery (PH II)		
Crude distillation CDU	--	150,000 b/d
Vacuum Distillation	VDU	150,000 b/d
Naptha Hydro treating	NHU	53,560 b/d
Catalytic Reforming	CRU	33,000 b/d
Kerosene Hydrotreating	KHU	14,5000 b/d
Catalytic Cracking	FCCU	40,000 b/d
LPG Merox	--	11,500 b/d
Gasoline Merox	--	24,680 b/d
Dimersol	Dim	4850 b/d
HF Alkylatium unit	HFALK	7020b/d
Butana Isomerisation	BUT	3610

Source: NNPC Annual Report 2005

The old refinery has its own utilities and tank farm. The utilities consists of water, boreholes, water treatment, cooling water, tower instrument and steam boilers, the only activities supplied from the new refinery are power and nitrogen by air. The oil refinery was designed to generate its own gas as process fuel.

The new refinery consist of the following utilities shown in table 2.9

Table 2.9: Refinery Utilities

Utility	Capacity
Electricity-Steam turbines	4 x 4 mw
Steam Boilers	4 x 120 t/hr@ 42.7
Cooling water	14,000 m3/hr
Demineralised water	140m3/hr
Nitrogen	600 Nm3/hr
Instrument Air	3 x 2,500 NM3/hr

Source: NNPC Annual Report 2005

The refinery is configured to produce various yields of the following crude oil products:

- Crude Low Pour Fuel Oil (LPFO)
- LPG High Pour Fuel Oil (HPFO)

2.5:5: The Operations of the Downstream/Upstream Sectors

The downstream sector has been a major problem for the country over the past years as the NNPC has found it impossible to maintain the country's four refineries and to provide adequate supply of PMS, diesel and kerosene nationwide.

Prior to 1999, the product supply and distribution business was characterized by under-funding and inadequate maintenance of facilities. Refinery capacity utilization was very low.

The pipelines and depot were unable to meet products requirements nationwide, while the tariff structure was inadequate to cover expenditures. The result was incessant fuel

shortage, long and winding queues at the retail stations, product adulteration, fuel smuggling across the borders and generally a collapsing downstream sector. This situation constituted an embarrassment to the government. According Onoh (2000:14), the objectives of the government at that period was to

- Improving supply and distribution performance, thereby eliminating fuel shortages,
- Address ownership and management structure of the refineries, pipelines and depots;
- Complete the process of price and market liberalization in the downstream sector.

To achieve these objectives, government commenced rehabilitation of the refineries. Between 1999 and 2003, a total sum of \$485,448,688 has been spent on rehabilitating the refineries. In addition, a sum of \$254,364,232 has been spent on rehabilitating pipelines and depots in the last four years (Akpiayi, 2005:35).

In order to consolidate and sustain the gains of the broad objectives stated above, government decided to deregulate the downstream sector of the industry. The private sectors were encouraged to source for petroleum products either through importation or the establishment of private refineries. To date, eighteen (18) licenses have been issued to prospective investors, while NNPC's monopoly of products supply has been broken through direct importation, storage and distribution of petroleum products by private investors. Already, products are now widely available and competition has begun to set in. In fact, NNPC has also diversified into retail business through the establishment of its mega stations in different parts of the country. In addition, the climate for private sector investment has been made congenial by deregulation and market oriented policies.

The upstream sector has provided a ray of hope. Crude oil reserves and productivity continue to rise, giving hope that the industry might meet government's aspirations of

crude oil reserves of 40 billion barrel and productivity of 4.5 million barrels per day by the year 2010. In the direct upstream business, the strategic alliance with Agip Energy has ignited hope that NPDC might become a medium-sized oil producer in the very near future in line excess of 55,000 barrels of oil per day up from just above 12,000 barrels per day in 2002/2003. Reserves and productivity were set to expand with the exploitation of wholly-owned offshore acreages of Okono and Okpoho

2.6.1 The Nigerian Oil Industry: Looking Towards the Future

The planned growth and potentials of the industry creates significant opportunities for Nigeria as a nation as well as investors. Current crude oil production is over 2 million barrels per day (mbd), while crude oil reserves and production capacity are 35.0 billion barrels and 3.0 mbd respectively. Natural gas reserves have also increased to 187 trillion standard cubic feet. While the sector has remained the pillar of socio-economic development and growth, it is poised to play an even greater role in the Nigerian economy with current efforts to increase crude oil reserves, monetize the vast natural gas resources and integrate the power sector into gas industry in order to expand electricity generation capacity. The on-going institutional and organizational restructuring, capacity building as well as the local content development strategy tended to accelerate overall national development.

The on-going transformation in the petroleum industry is part of the federal government's overall reform Agenda to place Nigeria on the path of growth and sustainable development. These reforms in the oil and gas sector are to revitalize the sector into becoming a catalyst and engine of growth for national development.

The petroleum industry is now opened up for private sector investment in order to infuse capital and technology. Nigeria being the gateway to oil and gas business and with a

record to stability in sub Sahara Africa, it has become the natural choice of investors in oil and gas business.

In order to reposition the industry, the Nigerian National Petroleum Corporation (NNPC) has been restructured into a world class National Oil company to mid-wife the entire industry. The repositioning strategy ran through the entire spectrum. The repositioning aspirations in the sector include (Onoh, 2000:12-15)

- Growing crude oil reserves to 36 billion barrels and reducibility to 4 million barrels per day by 2007.
- Maximizing the sector's value;
- Improving Nigerian capacity and local content

To complement the efforts of joint venture partners, the NNPC established the National Petroleum Development Company (NPDC) as an exploration and production (E&P) subsidiary. The strategy is to grow NPDC into becoming a world class E&P Company. To this end, capacity building is being encouraged. Its near term goal is to increase production from 50,000 b/d in 2005 to about 150,000 barrels per day by 2007 (NNPC, 2005). In addition, the Nigerian government is actively promoting the internalization of inputs in the upstream sector. The objectives of the local content policy are to promote a framework that guarantees active local participation without compromising standards, to promote value adding in Nigeria through utilization of local law materials and human resources, and to promote steady, measurable and sustainable growth of Nigeria content. At present, legal, regulatory and institutional structures and mechanisms to drive the actualization to the local content programme are being put in place.

In order to increase indigenous participation in the upstream sector, marginal fields were awarded to competent local entrepreneurs. The marginal field development strategy was aimed at engaging the pool of high level technically competent Nigerians in the oil and

gas business, providing a spring board for into operations in the less conventional terrain leading to greater opportunities for technological transfer and increased employment generation. The Nigerian economy in general and the oil industry in particular are rapidly transformed for greater efficiency and sustainable growth. This entail among other things, market reforms, diversification of the revenue base, magnetization of the vast natural gas resources and encouragement of E & P operations in new inland basins, deep offshore and the gulf of guinea. The future portends enormous growth and business opportunities. The Nigerian oil industry is poised to exploit these opportunities in partnership and in collaboration with present and prospective investors and operators who possess the requisite capital, managerial expertise and technical know-how. The opening up of both upstream and downstream sectors have led to increasing participation of Nigerians as well as building indigenous capacity in the industry. New industries have been created, boosting industrial growth and creating employment opportunities, avenues for acquisition of modern technology and increasing business and contracting opportunities. The Nigerian Oil Industry stands out in Africa as a place of opportunities where all genuine investors should exploit.

2.6:2: Management: A Factor in the Operations of NNPC and its Subsidiaries

Several studies have been done on how oil has influenced Nigerian economic and political life. This study draws on both past studies and recent cross-national studies to cast light on the management, economic and political implications of Nigeria's oil wealth.

It would be difficult to exaggerate the role of oil in the Nigerian economy. Since the first oil price shock in 1974 (Okoye, 1982:35) emphasizes that oil has annually produced over 90 percent of Nigeria export income, making Nigeria the world's most oil dependent country, and has a profound effect on Nigeria's domestic sector. One way to

characterize its impact is by looking at the rents produced by oil, that is, the returns in excess of production costs in the Nigerian economy.

From 1970 to 1999, oil generated almost \$231 billion in rent for the Nigerian economy (Onoh, 2000:20). Since 1974, these rents have constituted between 21 and 48 percent of GDP, yet these rents have failed to raise the income and done little to reduce poverty. The lack of improvement is striking, given the size of Nigerian's oil windfall. Since the early 1970s, the government has annually received over half of its revenues, sometimes as much as 85 percent directly from the oil sector. These oil revenues are not only large, they are also highly volatile, that is, they fluctuate drastically in size from year to year, causing the size of government and the funding of government programmes to fluctuate accordingly. For example, from 1972 to 1975, government spending rose from 8.4 percent to 22.6 percent of GDP. By 1978, it dropped back to 14.2 percent (World Bank 2002).

The decentralization of the government functions made revenue management more difficult, since much of the oil revenue passed on from the federal government to the state and local governments. The Nigeria's oil wealth has led to social and political unrest, particularly in the Niger Delta. The former Eastern region's effort to secede from Nigeria, led to the 1967-1970 civil war which deeply rooted in ethnic tensions.

The rebellion was encouraged by the presence of oil. Similarly, the unrest among the Ogoni and Ijaw people in the Niger Delta could in part be traced to their desire to win a larger share of the region's economic wealth. The problems created by abundant mineral wealth are not unique to Nigeria. Mineral exporters tend to suffer from a cluster of economic and political ailment (Auty, 2001:75). Recent econometric studies show that states that depend on mineral exporters tend to have a typically slow economic growth (Sanda, 2002), abnormally low rates of democratization (Ross, 2003:15) and sharply

higher risks of civil war (Fegron and laitin, 2003:12) In general, the more states depend on mineral exports, the more likely they are to suffer from these problems. Since Nigeria is remarkably dependent on oil, it has been highly susceptible to these tribulations. In addition to the ailments above mineral dependence also tends to aggravate poverty (Ross, 2003:15). There are five ways that mineral wealth can hurt the poor (Ross, 2003:15);

- By causing economic volatility
- By crowding out the manufacturing and agricultural sectors
- By heightening inequality
- By inducing violent conflict
- By undermining democracy

Oil wealth could harm the poor by creating economic volatility which tended to hurt the poor in two ways; by causing macroeconomic shocks and by making government revenues unstable. In essence, the volatility of the oil sector produces volatility in government revenues. The more that the government relies on oil, the greater the impact that oscillation~~s~~ in oil prices might have on the government. In addition, revenue volatility hurt the poor by causing instability which depends in part on economic growth, which in turn depends on a stable set of government policies and institutions.

Studies by Sanda (2001:10) reported that a large petroleum industry could reduce the number of jobs for the poor by causing "Dutch Disease". The Dutch disease occurs when a booming inputs for the manufacturing and agricultural sectors. Both of these effects tend to raise the price and hence reduce the international competitiveness of exports from the manufacturing and agricultural sector, hence, the net result maybe an absolute decline in opportunities for the poor.

Ross (2003:21) studies found that the oil wealth tend to make states less democratic. This effect works through three mechanisms. First, when government has abundant oil

revenues, it is less likely to impose taxes on the general population. The taxation process typically forces government to become more accountable to the citizens. Second, government with abundant oil revenues tends to spend heavily on their military forces by developing a more effective repressive apparatus. Third, oil development generally does not lead to industrialization; it can even retard industrialization by causing the Dutch Disease. This tend to weaken democracy, which in turn harm the interest of the poor

Oil wealth has repeatedly contributed to the outbreak of violent conflict in Nigeria by exacerbating tensions between the oil rich Niger Delta and the rest of the country. Since 1990, the Niger Delta has been the site of much political violence. The demand of local ethnic minorities for a greater share of oil communities argued that oil development had led to environmental degradation, health problems, the deterioration of fishing grounds and a genocide against the Ogoni people. In 1990, the demand of local ethnic minorities for a greater share of oil communities argued that oil development had led to environmental and a genocide against the Ogoni people.

The federal government made efforts since independence to address poverty in the Niger Delta, first through the Niger Delta Development Board from 1993 through the oil Minerals Producing and Development Commission (OMPADEC) and since 1999 through the Niger Delta Development commission. The federal government made series of financial concessions to the oil producing regions. Yet, community demands for greater autonomy and greater control over oil revenue continued to escalate, more groups continued to obstruct the activities of oil firm in order to press their demands. In 1999, the Obasanjo government made major progress towards rectifying the oil sector's problems, which include:

- Peacefully resolving boundary disputes over offshore oil rights with neighbour Cameroon, Sae Tome and Principe and Equatorial Guinea

- Resolving a dispute between the federal government and the littoral states over the division of revenues from offshore development.
- Aggressively moving forward with a plan to end the flaring of natural gas.
- Moving away from joint ventures contractors and towards production sharing contracts with oil.
- Addressing at least some of the demands for greater oil revenues and social development in the Delta region.
- The government encouraged the development of offshore including the deep water (Onoh 2000:15).

Collectively, these reforms were intended to increase or reduce the likelihood of conflict in the oil producing states, ease the attractive environment for international firms and diminish the volatility of petroleum revenues. All of these reforms were good for the economy and ultimately beneficial; to the poor.

2.7:1 Foreign Participation in the Development of the Nigeria's Oil Industry

The Nigerian economy is largely dependent on its oil sector which supplies about 90 percent of its foreign exchange earnings. The upstream oil is the life-blood and yet it is also central to the on-going civil unrest in the country. Despite problems associated with ethnic unrest, border disputes and poor government funding, Nigeria oil wealth made it most attractive to the multinationals oil companies.

The multinational oil companies participation in the oil industry dated to the early 20th century, when European authorities recognized oil as the fuel of the future and encouraged private business to undertake aggressive exploration all over the world. In 1906, a British businessman, John Simon Begheim convinced the colonial office and the government of Southern Nigeria that based on the knowledge of the region's geology, Nigerian Bitumen Corporation could find it. For the next six years, the prospecting rights

rewrote mining legislation, and at their request, created the Southern Nigeria regulation (Oil Ordinance) of 1907, petroleum. Shell, whose forerunner, Shell D'Almeida was a pioneer of oil exploration in the country, today is the leading oil company in Nigeria. The company assumed its present day name in 1979, namely Shell Petroleum Development Nigeria Limited. Shell Petroleum Company of Nigeria Limited (SPDC) is the largest oil and gas exploration. It is a joint venture in which NNPC holds 55 percent, ELF 10 percent and Agip 35 percent. Today SPDC produces almost half the country's oil from the Niger Delta area. It also supplies 95 percent of the country's commercial mining leased area of 31,000 square kilometers. The scale of the company's operation is massive, involving of 6,200 kilometers of pipelines, more than 1,000 wells, 87 production plants and two large oil terminals at Forcados and Bonny. The company is divided into two divisions, based in Warri and River states with a small corporate office in Lagos. The company's involvement in utilization of Nigeria's natural gas began when it initiated a project to supply gas to some industries. Mobil is another leading actor in the Nigerian oil predecessor company evolved into the present day Mobil Oil Nigeria petroleum product more than six million barrel a year. A major industry involved the commissioning of Mobil's OSO- Natural Gas Liquids (OSO or NGL), a joint venture in which Nigeria holds equity (through NNPC) as against Mobil's 51 percent.

Chevron Nigeria Limited began its exploration and production as Gulf Oil Company in December 1961, when it obtained a prospecting license from the federal government. To facilitate its operations in the concession area, the company established a base at Escravos, near Warri in order to co-ordinate its operations and another in Port-Harcourt. On April, 1965, the company commenced export, shipping Nigeria's first off shore crude to the and the Nigerian National Petroleum Corporation (NNPC) initiated a process of participating working interest. The Nigerian government acquired 35 percent stake, later increased to 60 percent. Leading multinational oil companies focused on the introduction of best practices and performance management all around their operations. In order to

support their initiatives, they deployed systems that could help them plan, track and measure activities and programmes. Initiatives such as benchmarking and knowledge transfer that could be used to carry data and information to the users. Operational excellence expressed in terms of asset reliability, cost of operation and risk management. An observation of behaviours and processes of multinational companies involve in E & P tended to suggest that the risk associated with technology deployment was weighted against the cost of acquisition and deployment of technologies. Technologies with high probabilities of success, even at high cost could easily be deployed, depending on the effect it might have on the availability of funds for the acquisition and deployment of technologies. The risk associated with technology deployment could be in terms of poor construction and maintenance of the facility, which resulted in available reworks and led to substantial cost overruns. For this reason, the selection and deployment of a new technology, irrespective of the cost impact should consider the probability of success of the project.

In the early 1970s and the late 1980s, multilateral technology was not deployed in Nigeria's Exploration and Production Oil Industry (E&P) because of the shortage of technological skills in Nigeria, in spite of its cost benefits. Most E & P companies rated the risk of failure high due to the absence of skilled personnel at that time. Porter (1985) argues that technology strategy reinforces the competitive advantage a firm is seeking to achieve and sustain. The most important technologies for competitive advantage are those that could skew either cost or differentiation drivers in favour of a company. This implies a free and unmitigated diffusion of technologies.

Porter (1985:98) suggested that the rate of diffusion of technologies was an important factor in determining sustainability of technological investment.

2.7.2 The Challenges of Nigeria's Oil Industry

Since the discovery of oil in commercial quantities in 1956, and the oil boom of the 70s, the oil industry has become the backbone of the Nigerian economy, accounting for over 90percent of the total foreign exchange and nearly 80percent of government revenues. Oil and Gas Journal (2005) estimates Nigeria's proven oil reserves at 35.2billion barrels, with the majority of oil found in numerous, small producing fields in the swamps of the Niger Delta. Nigeria's crude oil reserves have gravities ranging from 210 API (American Petroleum Institute) to 450 API and approximately 65 percent of crude oil production in the country in light (350 API) and sweet (low sulphur content).

The main export crude blends are Bonny light (370 API) and forcados (310 API), with majority of the crude exports destined for markets in the United States, Western Europe and more recently, Asia and Latin America.

As a member of OPEC, the global oil cartel production in Nigeria fluctuated in line with the Cartel's response to world oil supply. Currently, daily production since August 2005 estimated at an average of 2.5billion barrels per day. Although Nigeria has substantial oil wealth, it is one of the world's poorest with more than 70 percent of the population living in poverty. The failure of successive government to shift Nigeria's heavy dependence on oil sector revenues to other sectors of the economy resulted over-time in an overall economic depression. A number of reforms intended to revive the economy and promote growth in all sectors was subsequently introduced by the Obasanjo administration among which was deregulation of the downstream oil sector. The downstream sector which covers the refining, petrochemical and transportation areas of the oil industry is controlled by government and indigenous operators, and in one area in which government has made considerable investment over the years. The sector has been a major problem for the country over the years, as NNPC found it increasingly impossible to maintain the country's refineries and provide adequate supply of premium motor spirit or petrol, diesel and kerosene nationwide. Factors such as low capacity utilization of the country's refineries and petrochemicals in Kaduna and Port-Harcourt, the neglect and repeated vandalization of state-run petroleum product pipelines and oil movement infrastructure

nationwide, the colossal damage of institutionalized corruption, the disturbing emergence of a local mafia that controls and co-ordinates crude oil, illegal bunkering nationwide, large scale cross-border smuggling of petroleum products and lack of resources to maintain and manage the resources have been neglected while social and economic infrastructure have been unprofessionally maintained. The inability to diversify the productive capacities has been the bane of our economy. The near total reliance on oil has led to utter neglect of other sectors. Related to the dearth of productive capacities was the near absence of technological capabilities leading to the low local value added in the industry. Experience has shown that the nation cannot continue to rely on a single resource for its economic development. The unpredictable and cyclical nature of the crude oil market with its attendant adverse impact on the country's economic and socio-political well being attest to the danger of over reliance on oil. Therefore, the challenge facing the nation in this sector is how to develop appropriate strategies for hydrocarbon resources for stimulating the entire economy and for sustainable development. In many ways, NNPC in its various roles as the manager of government investment in the sector and operator of its own ventures generally superintend over the industry, acting both as driver and motivator in an industry that has become highly sophisticated. The policies of government and the strategic focus of the NNPC and the attendant activities over the years have shown the pace of development of the Nigerian oil industry.

2.7.3 Strategies for Repositioning the NNPC and its Subsidiaries

The National aspirations of reserve and productivity enhancement, natural gas monetization and increasing intersectional linkages between the oil sector and the rest of the economy cannot be achieved unless there are efficient resources allocation and special attention given to research and integrated development. The industry need to embrace innovative ideas that would ensure that the country benefits maximally from the exploitation of its natural endowment.

The following strategies needed to be put in place if the oil industry is to be repositioned to face the challenges of this millennium and ensure sustainable economic development.

i. **Timely Funding of the Joint Venture Cash Calls**

The funding of Joint Venture Cash Calls has been a major challenge for the realization of the nation's planned hydrocarbon reserves and productivity enhancement. Several millions of dollars have been owed to the operators and this has created some creditability problems for the nation. In an effort to reduce the financial burden of this strategic business, the government has encouraged Production Sharing Contracts (PSC) for allocation of acreages. To effectively position the industry, the corporation continues to ensure that fiscal regimes were competitive and attractive to all investors while guaranteeing the stability of operations.

ii. **Capacity Building**

The oil industry is technology driven. Over the years, technology has improved tremendously in all phases of the industry from surface geology to seismic data gathering and interpretation, drilling, production, refining, shipping and distribution. In the upstream sub-sector, advances made in the acquisition, processing and interpretation of data go a long way to effectively locate potential hydrocarbon deposits at reduced risk and cost. The corporation should continue to encourage local fabrication work so as to effectively utilize resources and enhance local value added. The attestation of the Nigerian Engineering and Technical Company (NETCO) as world class engineering units confirm that such local capacity is available in house and should be encouraged to develop further. Towards this end, the research and development should be encouraged to participate in collaborative research and develop a modern research center with capability to use local material as substitution strategy. This process has the inherent advantage of boosting the entire local capacity building. The support of the entire oil industry on this drive should be solicited.

iii. **Reviewing Plant Maintenance Strategy**

With the deregulation and liberalization of the sector, on line and on-stream availability becomes the index of plant performance. In order to ensure and maintain the integrity of

equipment at facilities, a review of the maintenance strategy should be worked out. Equipment focused maintenance strategy should be developed while the training and development of the personnel should be aggressively pursued to ensure that new operators are up to date with the latest technology. The corporation is poised to become a net exporter of both crude oil and petroleum products, as well as meet the domestic raw materials requirement for the industrial take-off of the national economy.

iv. Enhancing the Local Value Added

The local content in the Nigerian oil industry is very low. The corporation should continue to support and encourage increased participation of local/indigenous core investors and engineering/contracting firms in the active participation in the industry. The corporation should encourage the pooling of resources and skills to form local consortiums independently or in association with foreign engineering and construction companies. This is another effort to take advantage of globalization and advances in technology, thereby developing the needed capability to face the challenges of the future.

v. Sustaining Industrial Harmony within the Oil Producing Communities

It is generally appreciated that development could only thrive in an atmosphere of industrial peace and harmony. In the past years, there has been increasing unrest in the oil producing areas because of the long neglect in terms of development. Flaring of associated gas and other forms of pollution arising from oil activities have done a lot of damage to lives and properties as well as ecology of the oil producing areas.

To effectively tackle these problems, government established the Niger Delta Development Commission (NDDC), to pursue an integrated development of the entire Niger Delta. The Commission should pursue the policy of adequately addressing the ecological factors threatening life and property in the area.

The current leadership of the industry should be poised to aggressively reposition the industry for its traditional role and enhance the inter-sectoral linkages that should enhance the per capita income and quality of life of the citizenry.

2.8 WHAT NNPC AND ITS SUBSIDIARIES SHOULD DO:

The petroleum industry in Nigeria has grown in size and complexity since the commencement of oil production in the country. The industry has become more sophisticated technically, financially and in terms of required skill and expertise. Without doubt, the industry currently accounts for most of Nigerian's wealth and also gulps a lot of money for high risk undertakings and cutting edge technology input, to which the country has a subliminal level of contribution with limited impact on the lives and living condition in the host environment.

As the nation pursues opportunities in the deep and ultra deep offshore where the financial and technological states are higher, the hope for the nation to participate effectively in terms of real input could be permanently dimmed unless something is done. Given what has happened in the industry in the last four decades, our hope is that we should ensure that future generations of Nigerians are able to benefit from the present abundance in terms of infrastructures and industries that should continue to thrive even long after oil might have lost its place in the global energy supply.

The issue of local content has become topical in the nation's discourse to the extent that it was even tabled for public hearing at the National Assembly. While this may have been necessary to generate a pool of ideas from where appropriate solutions could be developed, the issue of local content needs to be addressed. In the past, there seemed to have been different in understanding what constituted local content. Some understood local content as the increasing contribution of the Naira denomination in contracts awarded by the industry, while others believed that it is the extent of involvement of

Nigeria resources. In essence, local content is the utilization of the Nigerian human and material resources in the exploitation and development of Nigerian hydrocarbon resources (Onoh, 2000:12).

The Nigerian vision 2010, which has been endorsed by Obasanjo Administration, seeks to achieve at least 50 percent Nigerian content by 2010. This is a challenge to the industry and further underscores the need to look inwards and urgently identify specific areas, which can facilitate the achievement of this target. In order to do this, the industry should encourage and support the development of an industry support infrastructures, utilities, local contracting capabilities and accept Nigerian companies as service providers where possible. That the industry is technology driven and capital intensive is not in doubt but to imagine that forty-five years after the commencement of oil production in the country, virtually every input was sourced from overseas leaves a lot to be desired. The dearth of local technology and infrastructure is a problem as the industry still relies heavily on external sources for most of its material and technological inputs. The relevant industries that could supply materials to the oil sector are generally lacking in the country, whilst the required expertise necessary for the management of key activities especially offshore are glaring absent. The net effect of this resulted that most projects hardly be executed within the country's shores and where they are, the benefits still accrue largely to the external sources of blaze the trail in changing our economy to a productive one by addressing seriously the issue of improving local content in the industry and ensuring that:

- Exploration and production activities make substantial contribution to the economy by way of employment, investments and technology acquisition.
- Exploration and production projects should contribute through such areas as the development of infrastructures (roads, electricity), broadening the skill- base and providing opportunities for the expansion and development of the Nigeria Industry.

- Maximizing opportunities for local industry participation and providing details of how to achieve it.
- Providing data, which should allow for analysis of value-added in Nigeria from all projects executed in the country.
- Undertaking research, development and design in Nigeria to the maximum extent possible (Arliyo 2000:32-36).

It is therefore, incumbent on the industry to work within existing policy framework to promote the use of local materials and services. The planned development programmes of the industry in offshore West Africa should attract engineering construction companies and other service providers to set up their operations in the region. The impact of such a development on the Nigeria economy will be tremendous. The Nigerian oil industry should be willing and prepared to take advantage of the existing policies of government and in particular that on the Onne OGFZ with a view to contributing meaningfully towards increasing the local content in the industry.

Partnering and strategic alliance are important ways of spreading some of the benefits of the Onne OGFZ from the foreign participants to the local players in the industry. One of the primary objectives of seeking improved local content in the oil industry is the transfer of technology that would link the oil industry to other sectors of the national economy.

Capacity and sustainable development cannot be achieved without participation and education of people. Take for instance, Malaysia, the resources that the big multinational oil corporations brought to Malaysia including technical skills and experiences in managing complex high risk investment and strong financial assets played a significant role in enabling Malaysia to join the ranks of industrial nations. The expansion of their industry boosted the development of steel fabrication in Malaysia as local companies built structures such as platforms and decks to support offshore petroleum operations. Local fabrication not only created additional employment opportunities for Malaysia, but

also saved the country substantial foreign expenditures. Working with these multinationals, Malaysians succeeded in gaining knowledge and achieving technology transfer such that they have now mastered petroleum technology sufficiently enough to offer their services elsewhere in the world. This is what the NNPC and its subsidiaries should do for Nigerians.

In less than a decade, if the industry is committed to capacity building, Nigeria should be able to fabricate structures whilst educating Nigerians on highly sophisticated technology and operation systems. The industry can support its operations without jeopardizing cost, schedule, quality, safety or the environment by developing specific business practices to maximize participation of local business like, providing business with potential for long term economic viability. Second, interacting with local business to ensure they are aware of opportunities, bidding procedures and safety requirements of the industry.

Good infrastructure is vital for economic and social progress. This is true of any country in the world. The Onne oil and Gas Free Zone (OOGFZ) is well positioned to act as catalyst for the development of the required support infrastructures for the society, the industry must act responsible by maintaining and enhancing social capital as well as contributing to the nation's economic capacity to generate and distribute wealth meeting the needs of the present without compromising the ability of future generations to meet their own needs.

2.9:1 Government Policy on the Transfer and Acquisition of Information and Communication Technologies

The indispensability of oil revenue to the development of Nigeria is not in question, particularly given that the country derives about 90 percent of its export earnings from the sale of the commodity. Rather, what is questionable is the claim of the oil companies that technologies needed to mitigate such issues of gas flaring is presently beyond their reach. Such argument raises some logical questions on the federal government policy on

the transfer and acquisition of technology to the oil industry. Olisa (1987:22) argues that government policy on the oil industry was propagated through various legal and contractual arrangements, which guided operations and activities within the industry.

These legal relations according to Olisa include:

- The concession required the oil companies to solely bear all risks and costs of exploration, development and productions.
- The production sharing contract. This is an arrangement in which the output from the contract was shared by the parties in pre-determined proportions according to Omorogbe (1986:45).
- The service contract designed as an improvement on the production sharing contract. The distinguishing feature of the service contracts was that no title to or right over the production of crude oil s given to the contractor.

The technology argument made by the oil companies was quite paradoxical. The argument came at a time when technological innovations in the oil industry were rapidly increasing. The oil industry in Europe and America invested a reasonable amount of money in R&D on technologies drilling and enhanced recovery of more oil from formally depleted wells. The companies undertaking these technological innovations to enhance oil recovery are also the very ones operating in Nigeria. What these companies want the Nigerian public to believe is that, while technological advances have been done technologically to curb gas flaring after decades of oil exploration in the country. One cannot help but ask if this was intentional neglect or a technological oversight on the part of the companies.

From another perspective, it was argued that participation of the government in oil production and exploration activities under the joint venture programme with multinational oil firms incapacitated oil companies to stop gas flaring in the course of oil production. According to this view, the failure of the federal government to effect cash payment for its obligations in the operations of the joint venture partnerships constituted

a major obstacle for the oil firms to focus their attention on curbing gas flaring. Hence the argument emphasizes that the government could not credibly enforce gas flaring laws to penalize oil companies, since they failed to redeem its own obligation. This argument was right to some extent. It exaggerated the effect of the government's insolvency to the gas flaring phenomenon.

It is worth emphasizing that the policy of the previous military regimes in the country encouraged gas flaring by making it cheap for the oil companies to flare gas into the atmosphere and pay a fine of about 10 cent per 1,000 standard cubic. This is against the 10 dollars penalty required in developed countries, which discouraged the companies from flaring gas in such developed regions of the world. The transfer and acquisition of technologies in oil production might go a long way in minimizing the potential for unconfined flaring of gas in the numerous oil fields in various multinational oil companies operating in the country as they have presented it to the government.

Curbing flared gas could offer oil field operators significant safety and so many economic and environment advantages to other stakeholders, and might substantially reduce atmospheric green house (GHG) emissions thereby securing environmental stability in the region. Such reduction in emissions in Nigeria could possibly attract companies in the advanced countries seeking carbon reduction credit under the Kyoto Protocol programme of emission trading. This definitely might serve as source of income to the country.

The Obasanjo's administration policy on the oil industry centered on deepening indigenous participation and control various participation agreements have been signed in all concessions and programmed. It was expected that over time, Nigeria would take over 100 percent of all oil concessions in the petroleum industry. Already, Nigeria is

controlling 60 percent participation through NNPC with all multinational oil companies (Onwioduoki, 1994:52).

The mainstream arguments on the transfer and acquisition of technology centered on four major factors as indicated by UNCTAD (2000:32):

- Technology market imperfection and barriers between the developing country buyer and the developed country seller.
- The prevalent host government industrial policy and the package of incentives to investors.
- The policy of Nigerian National Petroleum Corporation (NNPC) in response to host country economic, industrial and technology policies.
- The existing political relations among the different social and political classes that compete for dominance in the determination and direction of state matters in the host country.

i. **The Imperfect Technology Market Argument**

UNCTAD (2000:32) was of the view that the capacity to acquire and transfer technology depended on the capacity in the country or an enterprise to generate and understand what to acquire. The views in literature were that patents, trademarks and restrictive practices determine the kinds of technology bought and sold. The literature maintains that they could directly be in the form of knowledge or indirectly embodied in goods and account for the high cost of acquiring technology as well as inhibiting different generation of technology.

ii. **Indigenization/Nationalization Arguments**

Turner (1982:15) emphasizes that foreign contractors were well established, experienced and familiar based in its country of incorporation. The companies have the incentive to establish local contracting capacity or to patronize those contractors that exist. The

transfer of oil technology did not occur without government intervention. The government intervention was to ensure that in the period during which the foreign firms realize their profits, about 15 years later, technology know-how should be localized.

iii. **The Displacement and Globalization Argument**

The multinational oil companies resisted the acquisition of oil technology expertise by nationals as part of wider company imperative to retain control of operations (Turner, 1982:15). The coordination, flexibility, size and organization of huge multinationals depend very much on the communication between management at various levels. Expatriates strived to remain in charge of key functions to the actual work of producing oil. Expatriates usually did the supervision of contractors and the maintenance of equipment. They did so to minimize by not committing an indigenous stratum to the institution and values of capitalism (Turner, 1982:15).

iv. **Political Economy Argument**

It was argued that the comprador nature of the Nigerian states prevented it from organizing the transfer of oil technology and more broadly from initiating the development of capitalist production. In Nigerian, the comprador state was based on the local commercial class. Middlemen were more numerous and influential as a result of the oil boom, the policy of import substitution and the state's policy of intervention to foster economic development. Turner (1982:15) observed that the middleman comprador alliance has been successful in suppressing the technocratic function within the state, and that along with the suppression goes the possibility of any significant state transfer of technology.

Generally, these determines to a large extent explain the differences in the levels of technological development in Nigerian oil industry. This study stresses that countries that present favourable indices have remained technological backward. It is obvious that these "developing countries" in spite of their success in conditioning their environment for the inflow of technology did not have the capacity in terms of trained manpower of acquire and develop technology. The result was the free entry and exit of foreign firms in the economy of these countries.

2.9.2 Capacity Building and Utilization in the NNPC and Its Subsidiaries

Technological capacity building and utilization have remained part of the strategies for tackling the questions of technological backwardness (Turner 1982:15). In contrast, most oil industries in developing countries, Nigeria in particular displayed a lack of attention to the relevance and development of institutional capacity building. This is not to suggest that the NNPC and its subsidiaries follow the same development path to technological capacity building and utilization like other advanced countries. The important lesson learnt is that the advanced countries experience confirmed the general views that human and institutional capacity building were critical to technological development. In this case, human capital refers in general to the productive capacity of the people in an enterprise or a nation as economic agents. Also, it refers to human acquisition of technological knowledge, skills and abilities through education and learning for productive purposes which constitute human capital. Capacity building could therefore, be viewed as a series of activities, which an organization, enterprise or even a nation need to undertake to provide for itself on a continuous bases, a regular supply of skilled man power to meet its present and future needs (Tassey 1992:26). The prosperity of the NNPC and its subsidiaries or even the nation, to a large extent depended on the competence of its workforce. As noted by Akieyi (2005:36), in the 21st century, the major source of competitive advantage certainly lies not in technology, but in the dedication, the quality of the commitment and above all, the collective competence of the workforce.

As a resource and like some other factors of production, human capital has a life span, not in terms of life expectancy at birth but life span measured by economically active period. In the Nigerian context, economically active period is usually between 15 and 65 years, or at most 70 years. The requirement for human and institutional capacity building generally exist within the social and political environment. Thus, capacity building in a broad development context implies a dynamic process, which enables individuals and agencies to develop the critical social/technical capabilities to identify and analyze problems and proffer solutions to them. A conducive policy on environment is therefore,

sine-qua-non for the process of Technological capacity Building (TCB) to thrive without hindrance. The policy environment for TCB should be multi-sectoral, involving government, universities, research centers, the private sector and other stakeholders. This is important in any political environment that is characterized by social and ideological heterogeneity. Broadly, defined technology is not necessarily hardware, but a totality of knowledge and skills embodied in people and institutions, which provide them with mastery over their natural environment. The role of capacity building in this context therefore is to harness the capabilities within the network of institutions and enhance organizational interactions to better manage the process of technology acquisitions, diffusion, utilization and skill development. A general policy environment that induces human and institutional interaction and collaboration became necessary for effective technology policy management and capacity building. Two critical social forces in the policy environment in Nigerian oil industry are the government and the bureaucracy (Oni and Akerele, 1997:44). These two institutions are critical to the extent that well-intentional policies may produce undesired outputs if the people charged with their implementation do not possess the necessary scientific background (Dahlman, 1989: 13-16). Trained experts could only be productive within an appropriately designed institutional framework and not outside it. Such institutions exist in an appropriate policy environment where research institutes, university laboratories and the private sector are encouraged to build a network of information, knowledge and personnel exchanges. The above suggested the intellectual relevance of a holistic approach that describes and also prescribes a structured and dynamic relationship between institutional networking for technological capacity building and the environment. The Nigeria oil industry has the resources and market for industrialization but the poor knowledge of its managers and weak technological institutions according to Richman (1997:292-294) constitutes major constraints. In a country where the education and training systems are not geared to the need of industry Richman concluded that more productive technology cannot be employed. The implication of this fact is that a science and technology policy framework

should be designed to guide all research and development activities for the promotion and utilization of technology. It should also incorporate a strategy for Technological capacity Building (TCB) as a continuous social process. Technology policy is a set of inter-related policies that structure the process of technology acquisition, utilization and diffusion (Dahlman, 1989:13-16).

sAdubifa (1990:20) makes the same point in his definition of technology policy as a framework consciously put in place for the purpose of acquiring and utilizing scientific and technological knowledge in order to achieved national development objectives. The effective performance of this framework according to Dahlman (1989:25) requires enormous amounts of financial, human and strong organizational or institutional capability to develop this capability. The Nigerian oil industry requires appropriate policy, necessary institutions and structures which should be sustainable.

The environment within which technology thrive is important because technological innovation and scientific discovery are often not the product of work by an individual scientific or research institution (Wangwe, 1997:12). The building of network is seldom without management problems (Wohlmuth, 1998:25). Public policy intervention is an essential ingredient in networking because of the danger of market failure in policy design. This is because technological capacity building through networking involves what Bell and Pavitt (1992:14) described as the determinants of successful technological accumulation. These are acquisition of foreign technology, investment in education, training and research, economic incentives for innovation and imitation, continuous growth in demand and linkages designed to encourage the accumulation of technology.

Capacity under-utilization and low retention due to brain-drain constituted problem area in capacity building in Nigeria. An evaluation of structural adjustment programmes reflects a lack of capacity and management skills, while bad governance and instability

tend to decapitate potentially efficient administrative machinery. Bossuyi (1995:18) suggested that capacity building issues particularly through networking touch on many sensitivity, which include governance, quality of leadership, management philosophy and resource allocation strategies.

Capacity building through institutional networking should be grounded in an appraisal of the environment. The management of what Rondinell (1998:24) recommends for effective TCB in any nation requires complex interactions among stakeholders that is co-operation and co-ordination within the community of actors. These actors are the universities, research institutions, industry foundations and government. In Nigeria today, the universities lack up-to-date facilities for teaching and research. In most developed countries, the increasing complexity of the network among many research institutes enables them to internalize knowledge and technology through the use of Information communication Technologies (ICTs). The frequency and speed of interaction among these institutes have risen in the last decade especially with the framework of technological globalization. In assessing the Nigeria oil industry effort in technological capacity building, successive government have adopted economic growth policies designed to harness both the human and natural resources of the country, while many other sectors of the economy have continued to experience decline. The human resources developments in the NNPC and its subsidiaries have shown dramatic increases over time.

The federal and state government sees the oil industry as a central pivot of development planning. In spite of huge economic potentials, Nigeria still remains one of the poorest countries in the world (Oni and Akerele, 1997:14). With its arable land, flora, large population size and vast oil resources, the country is unable to utilize its universities, research institutes, industry and local expertise and other institutions to pull itself up from its current level of under-development. This is so because of the country's low level of human and institution capacity. Huge public and private bureaucracies and institutions

and vast reservoirs of natural resources cannot provide, let alone develop institutional capabilities.

Oni and Akerele (1997:14) emphasizes that there should be a deliberate collective effort directed towards capacity building. Collective effort involves the role of the government in promoting and sustaining inter-agency cooperation in national policy on technological capacity building. To be able to achieve the goal of TCB, the government should institutionalize and co-ordinate TCB as an important social engineering process that could be sustained in order to produce the desired result. By virtue of Nigeria size, natural resources and economic the situation on ground do not present any better picture. According to the Human Development Report (2002:22) indicated that 65.6 percent of Nigerians lived below the poverty line. The poverty levels were 27.2 and 46.3 percent in 1999 and 2000 respectively. As a way forward, we need to bear in mind that the whole essence of capacity building and utilization are to improve the standard of living of the people. From the foregoing analysis, one should realize that there is a long way to go if the objective of capacity building is to be achieved. Bearing in mind the efforts of democratic government of President Olusegun Obasanjo which included anti-corruption bill, frontal attack on cultism, increased funding for education, actions were suggested along the following lines:

- Provision of enabling environmental for business to thrive
- Increased collaboration and cooperation between public and private sectors
- Probity and Accountability
- Monitoring of Educational institutions
- Vocational training

It has been shown that capacity building and utilization efforts are still open to a lot of initiatives. There is the need for synergy on the part of both public and private sectors for optimum results, and this is critical success factor in the years ahead. There is also the need for the pursuit of capacity building that could equip people with the skills and competencies that are required both for employability and job creation as well as entrepreneurial development. Government has the responsibility to create a conducive

environment for business to thrive and for industry to play the expected drivers' role in the emerging economic scenario.

2.9.3 Information and Communications Technologies Development in Nigeria

Developments in Information and communication Technologies (ICTs) recently have been among the fastest growing business in the world. The question is how the Nigerian oil industry with its enormous potentials continues to remain a sleeping giant? Recognizing the potentials of Information and Communication technologies (ICTs) to transform development it is obvious that the information revolution have not been made available to all institutions in Nigeria. The telecommunication infrastructure was inadequate to meet the challenges of the information age. While the impact of the information revolution is tremendous, the existing infrastructure, socio-economic cultural and political situations pose major difficulties in introducing, implementing and diffusing the new technologies for inter networking. The technology and funds are not necessarily the major inhibiting factors, but the will and awareness do not seem to be present, although the poor telecommunication system made the matter worse. The NNPC and its subsidiaries deserve investment opportunities for the development. The investment should move beyond solving problems and promoting academic achievements to support full range of positive outcomes geared at getting information Technologies to the doorstep of every unit in the oil industry irrespective of the location of the unit.

The path to ICTs development should be such that the people are made a veritable component. The National Information Technology Development Agency (NITDA) has recognized the workforce in actualizing the nation's information technology policy. The agency targets at developing and empowering youths with IT skills to make them globally competitive. Efforts in this regard include:

- Provision on Information Technology (IT) facilities for the various levels of the educational system to support the necessary restructuring to cater for the challenges of the information age.

- Promoting training the trainers scheme using existing establishments such as the National youth service corps (NYSC), the National Directorate of Employment (NDC) to boost capacity building in Information Technology (IT).
- Organizing workshops to demonstrate the features and benefits of IT for performing artists through the ministry of youth, sports and culture.
- Encouraging massive local and global IT skills acquisitions through training in the public and private sectors with the view to achieving a strategic medium-term milestone by the year 2010. (Ojukwu, 2003:15-20)

As seen, Information Technology gives a new empowerment in the global competitiveness. Nigeria can use her comparative advantage of population to equip the people especially the youth to maximize this global market place for the development of IT in the country. The numerous ICTs initiatives in the country are geared towards the major goal of making the country globally competitive. For this to be sustainable, there should be full participation of all stakeholders, including government and the organized private sector. Knowledge is power. It is one of the shortest routes to development in the present world order. Encouraging the involvement of the Nigerian youths in ICTs development is a way for the development of a sustainable IT base for the nation.

Despite the fact that we started late, Nigeria is growing in ICTs market. The nation's budgets, Investment in ICTs human resources form a new base for the enrichment of the country. The youths should be the focus for such schemes. The average time for training a graduate on any specialized ICTs field should be around one year after which he/she might be in a position to be either self-employed or get employed.

The multiplier effect to the economy cannot be over emphasized. Programmes that would involve the re-training of unemployed graduates and school leavers should be embarked upon. This might lead to the creation of new jobs, generation of wealth through foreign exchange earning and indeed contribute to the alleviation of poverty in the nation.

Indeed, Information Technology constitutes the hope for the future for the Nigerian oil industry as well as for the Nigerian youths.

2.9.4 Achieving Sustainable Growth through the Adoption of ICTs

The explosion of ownership and ever-increasing performance capabilities of personal computers mobile phones and other information communication technologies (ICTs) devices, the development of satellite cable and other networks as well as increased bandwidth have spawned new forms of distribution through which the Nigeria oil industry products and services are made available. The restructuring of the NNPC and its subsidiaries and their inclusion in a trend towards an integrated information industry was driven to a large extent by major developments in technology. Castella (1996:23) refers to it as convergence. This convergence is based on technological innovations in microelectronics. Through digitalization, all kinds of data, irrespective of origin are manipulated and integrated on the basis of their common informational structure. In addition, the development of optical fibre and satellite technology created the possibility for rapid transmission of increasing amounts of information per second. The development of integrated circuits and the exponentially increasing capacity of microchips have been crucial for data communication.

The thrust of this study, which attempted to examine key challenges in the NNPC and its subsidiaries centered on the conviction that the industry requires a new value system based on science and technology-intensive knowledge, equity, justice and the rule of law to succeed. Above all this thrust is strengthened by the recognition and submission of the fact that the above vision could only be timely and meaningfully accomplished if we restructure the industry to be science and technology based, to be creative and quality knowledge intensive and to be globally competitive. The simple truth today is that no nation can effectively succeed in solving her 21st century development challenges unless the national vision, aspiration, mission and strategies are fundamentally anchored in the

realm of knowledge creation and strategically driven by science and technology with Information and communication Technologies (ICTs) being a key component.

Currently, all successful economies of the world are knowledge based and technology driven. They have established a new global society where the core value system is domiciled in the skills to create productivity by transforming knowledge and information into innovative products and services. There is a paradigm shift in global development and Nigeria cannot pretend not to be affected by its current and emerging impact. Any nation that wishes to attain and sustain meaningful development should therefore adopt science and technology, particularly information and communication technologies (ICTs) at the highest level and priority of its visioning, planning an nation-building process. It is for this and other significant reasons that nations have placed the highest development priority on building critical mass of their human capital.

Dependence on our natural resources (oil and gas) might not guarantee the future existence of the Nigeria-Nation. UNCTAD (2002:32) states that:

“A relevant education is more important today than ever, because today’s network demands a workforce that understands how to use technology as a tool to increase productivity and creativity.”

These skills include information reasoning, a processes in which reliable sources of information were identified accessed understood, contextualized and communicated to colleagues. There is an urgent need to re-define, update and re-focus on national development strategies to critically address ICTs intervention and constructive engagement in eight critical areas. According to Warren (1994:36-37), these include:

- Science and technology
- Infrastructure
- Education and Health

- Governance and Legislation
- Industry and commerce
- Research and Development
- Public and Private sector
- Global competitiveness

We are convinced and share the common vision that the survival of Nigeria-nation, especially the oil industry of the 21st century depends on the incubation and mastery of knowledge-base information and communication technologies (ICTs) and application system.

An important concept that highlights the role of information technology in competition is the value chain. This concept divides a company's activities into the technologically and economically distance activities it performs to do business. We call these value activities. The value a company creates are measured by the amount that buyers are willing to pay for a product or service. A business is profitable if the value it creates exceeds cost of performing the value activities. In essence, information technology is permeating the value chain at every point, transforming the way value activities are performed and the nature of linkages among them. These basic effects explain why information and communication technologies have acquired strategic significance and different from the many other technologies business use. The economic growth of any country depends to a certain degree on the ability of the country's business community to maximize their growth potential. This study in essence was undertaken to explore how the NNPC and its subsidiaries can achieve their own growth through the adoption of the information and communication technologies. The industry has been credited with enormous contribution to the growth of Nigerian economics.

The industry provided the cornerstones on which the country's economic growth and stability rest. Their importance to any economy hinges on their ability to stimulate indigenous entrepreneurship to provide employment to a greater number of people, to mobilize and utilize domestic savings and raw materials to provide intermediate raw materials or semi process products to large-scale enterprises. In Nigeria the introduction of mobile telephone encouraged a new generation entrepreneurs who use their Mobil phones to make money. The call center operators (entrepreneurs) make their money by using booster cards and through the discounts they get from the network operators through bulk purchasing. The above fact seems to validate the claim that information and communication technologies (ICTs) contribute to both poverty reduction and economic growth. Earl (1998:20) advances four reasons why every organization that wants to survive should itself get involve in ICTs;

- To gain competitive edge
- To improve productivity and performance
- To facilitate new ways of managing and organizing
- To develop new business

The impacts of ICTs on organizations have engaged the attention of a lot of social scientists. Preece et al (1994:12) identifies two main theoretical approaches, technological determinist and the social action models. The former asserts that technology, the ICT is the single most important factor in determining the success of an organization while the later sees technology as enabling rather than deterministic.

The third models called the 'integrationist impact' model seek to conceptualize the links between context process and human action and to highlight the mechanism through which such impacts evolve. This model propounded by Kimble and Mcloughlin (1995:14) introduces a new and very important concept in looking at the ICTs and its impact on the oil industry. It stresses the need for the inclusion of the human input in the

whole sector. It is in recognition of the premium position that human input occupies in the new technology that form the basis.

We believe that any organization that fails to recognize or accord the "human capital" its rightful place would not realize the expected benefits from these new technologies.

Kimble and Mcloughlin (1995:18) emphasize that:

"The impact of ICTS is not a single stable and predicible outcome, but a non linear ongoing process that changes and evolved overtime as the action of individuals and groups within an organization are not wholly determined by outside forces.

Daft (1998:56) stresses that growth are essential to attract and keep quality managers, to stay economically healthy, to enhance its competitive edge, to meet customers demands and needs and increase market share. In order to achieve growth, the organization need quality products and services that would attract and sustain their client's base. Growth refers to an increase in the size of an organization. We look at growth from distinct indices, level of achieved benefits, level of achieved business targets, level of achieved performances and level of reduced effects of operational problems in an organization's performance. One of the key sub-components of growth is the level of achieved performance. For the performance level of an organization to go up, some investments should be made on human resources (personnel Development). Put differently, the quality of the personnel in an organization affects the quality of the organization's performance as reflected in the quality of their goods and services. One major way of improving the quality of personnel is by investing in staff development, hiring and retraining quality staff, giving them training and acquiring modern office equipment (Daft, 1998:56).

The Nigerian National policy for information technology (NNIP) acknowledges that ICTs as bedrock for national survival and development in a rapidly changing global environment. With the launching of telecommunication satellite, Nigerian's tele-density would be enhanced.

2.9.5 Information Technology Acquisition: Need for Systematic Information Technology Strategy

This section of the study explored the argument what Port NNPC and its subsidiaries would benefit from a national systemic Information Technology (IT) strategy that enhances and accelerates the processes of development in the industry. Some of the issues surrounding IT acquisition are discussed, and the researcher highlighted a number of suggestions to incorporate on IT systemic approach for the overall socio-economic development of the country.

Information Technology is the backbone of the socio-economic development of the developed countries. Castells (1996:14-16) recognized it as the most important factor separating the developing countries from the developed ones. Countries are encouraged to attract economic growth by entering the information age and being able to supply or compete in the Global levels. It is no doubt that many developing countries are now trying to bridge the development gap by means of technology acquisition. Madon (2000:23-25) points out that "the rapid, diffusion of IT in developing countries has not been accompanied by substantial development benefits."

Madon (2000:30-32) further states that IT's use, if planned, developed and managed properly could bring about greater efficiency in the operations, better working environment and effective decision making process. Sachs (2000:38-40) in his article, "A new map of the world", argues that countries that do not keep up with IT often collapse and are unable to achieve socio-economic growth. In addition, Sachs (2000:38-40) asserts the scientific and technological progress are desirable for a nation to participate in the process of global integration. It is important for every country to develop a national ICTs strategy as a foundation whereby the great potential of ICTs could be realized, development promoted, technology exploited and communication problems alleviated.

In this case, the Nigerian government should play an important role, not only as a major user, but as regulator, promoter and diffuser. The NNPC and its subsidiaries require a good communication infrastructure and good human skill to accelerate socio-economic growth. With good infrastructure and skilled human resources, NNPC and its subsidiaries can develop its IT sector, provided government policies are designed to promote ICTs production directly, support ICTs industry research and development, and create education policies that can provide appropriately trained labour pools. When used effectively ICTs supported by the government, information technology could bring gains in the form of better product quality, greater flexibility and better quality of life for the general populace.

In a study by Nicholson and Stepina (1998:42-45) in developing countries, they noted that variables such as gender, power structure, and education level play an important role in determining the process of technology adoption.

Based on a study, Chandler (1977:72-96) asserts that systematic strategies to assist understanding as to how the technology acquisition mechanism can best help to achieve sustainable development are embodied in the following factors:

- All key stakeholders actively and genuinely participate in all aspects of the technology acquisition process.
- Information Technology capability in terms of human resources development, infrastructure development and institutional development should be strengthened through both foreign and local routes.
- Monitoring and evaluating mechanism should be strengthened through both foreign and local routes and implemented effectively.
- Inter and intra organizational linkages are necessary to take advantage of new economic opportunities.
- Promote the sharing of Information and resource, integration of information systems to facilitate the smooth flows of information.

- Provide the necessary telecommunication infrastructure to develop, use and diffuse.
- Encourage and assist the IT professionals in order to maintain professional standards and to provide for career development.
- The government should aim for policy consistency and to avoid confusion within the IT sector.

Appropriate Information Technology at the level of the policy makers means that Information Technology provides the way for or support activities, which in national terms are seen as desirable.

2.10 THE INFORMATION AGE: KEY TO NIGERIA'S RENAISSANCE

Oil currently accounts for about 90 percent of Nigeria's exports and is the bedrock of the Nigeria economy (Onoh, 2000:16). Nigeria real-time economic performance is largely tied to world oil prices. Given Nigeria's huge oil reserves, the high oil prices resulted in a booming of Nigerian economy.

Given Nigeria's near total dependence on oil, this trend represents a very serious long-term threat to the country's economy. It seems clear that the global economy in the 21st century would revolve mainly around Information Technology. Over the last year, the technology sector in the United States took a half percentage point off inflation, in addition, added almost a full point to economic growth. Due mainly to the technology sector, real-wages in the United States are expected to rise by nine percent over the next ten years. This year, the computer industry in the United States accounted for about 5 percent of the GDP. Over the next ten years, this figure is expected to be more than double. Indeed, the high technology industry is credited with being one of main reasons why the United States recently enjoyed its first budget surplus in decades.

The potential benefits of the Information Age to the Nigerian economy are boundless. Nigeria's standard of living would improve. The primary focus of Nigeria's public policy should be on rebuilding the country's infrastructure. Privatization with appropriate doses of regulatory oversight would accelerate this process or at the very best, set it on the proper footing. The sheer size of Nigeria's human capital provides the country with the market volume that would attract investors wishing to exploit this business model. As we move in this millennium, intellectual assets are fast replacing physical and natural capital as the most strategic resource of country. With the quality and volume of brain-power, Nigeria can become globally competitive even with economic power-houses like the United States and Japan. The country need to manufacture and export intellectual capital in unseen quantities. The resources are there, they need to be directed, motivated and exploited. In the next few years, as intellectual capital achieves more and more prominence, Nigerian programmes and other high tech workers would have to compete for jobs with their Chinese, Mexican and Russian counterparts.

As technology appears pervasive, the intellectual barriers to entry become lower. As software permeated every sector of society, the level of abstraction of its ingredients has increased. As a consequence, Nigerians have the chance to choose software development as a career regardless of background. Software engineering largely based on logical thought does not require as much formal training as other fields. Other high-tech jobs, like those involving the creation and maintenance of web-sites are even more pedestrian in nature. These characteristics allowed Nigerian the opportunity to churn out programmers and web-site authors in volume. However, one problem that has stymied the development of the software industry in most developing countries, including Nigeria is piracy. Given the current economic crunch in Nigeria, the business model of selling shrink-wrapped software became untenable. The advent of the Internet and the paradigm shifts in high technology business models gave Nigerian entrepreneurs a tremendous

opportunity. The problem with shrink-wrapped software was that once out of the store, the seller essentially is at the mercy of the buyer's goodwill.

The Information Age would not have the envisioned impact on Nigeria until the country's infrastructure is revamped. The power grid and the telecommunications network need to be up-graded. Wireless base stations and systems need to be installed.

While over-hauling its underlying infrastructure, the Nigerian government should promulgate a policy to develop a new National Information Infrastructure targeted at providing narrow-band and broad-band telecommunications services to its citizens. The country should monitor the pulse of satellite development programmes and position itself to take advantage of the economics created thereof. Policy measures should be put in place to attract investment capital for the construction of wireless telecommunications networks.

The debased state of Nigeria's capital projects clearly indicates the inaptitude at maintaining the national infrastructure. The nation's telephone networks, refineries, hospitals, schools, roads, bridges and National monuments are all in a state of disrepair. Any policy for rebuilding the existing infrastructure or erecting replacements, without a formal recognition of the lack of accountability and maintenance culture would be severally flawed. A national maintenance policy needs to be drafted and localized in every sector of the economy. Government awarded contracts need to be supplemented with maintenance clauses.

The increasing value of intellectual capital requires Nigeria to make long-term strategic investments in rebuilding and enhancing its educational systems. Pedagogical emphasis should be placed on computers, mathematics, programming and other software skills. A commitment to long-term research and development in computer science should be an intrinsic part of long-term policy on tertiary education. The Universities should be

properly funded with some focus on software engineering. A natural Information Technology foundation similar to America's National science Foundation should be created to fund computer projects in Nigeria's Institutions and Research Laboratories.

In order to stimulate innovation, awards and grants should be given annually to top-notch professors and students in the research community. Partnerships between the government, Universities and industries should be developed and nurtured. Given the historical imbalance in gender-based representation, the government should encourage the participation of women in the Information technology sector.

Nigeria should build a new technological institute of first class pedigree similar to the Massachusetts Institute of Technology (MIT) or the Indian Institute of technology (IIT), whose sole role should be to generate technical talent of the highest quality. In the long-term, the technological institute should be the source of intellectual Information Technology leadership in Nigeria. In this respect, the institute educational policy should be aimed at ensuring that over the next few decades, a subset of its graduate would pervade the upper echelons of Nigerian Corporate Organization. This would provide the graduates with physical and intellectual ammunition necessary to compete more effectively on a global scale. Nigeria should develop a digital 'mini-city' akin to America's Silicon Valley which would be the country's centre of high-tech intellectual power and commerce. In recognition of the importance of the Information age and its potential, Federal Information Technology commission should be established. This body should be charged with formulation and implementing Nigeria's long-term Information Technology policy should be well funded, supported and should be given the necessary latitude to execute its policies, free of undue red tape.

The mechanics of its interaction with existing ministries should be explicitly defined in order to preclude bureaucratic contention. The organization should be comprised of

intellectual with expertise in germane fields like computer science, engineering, economics, education, Business and Public Policy.

In addition, a presidential Information Technology Advisory Committee comprising of members of the private sector should be included to complement public policy of the government. Once the national information infrastructure is in place, the Nigerian government needs to exploit it in order to improve the efficiency of its own operations. The information infrastructure needs to be carefully engineered and compartmentalized to guarantee strategic redundancy and locality in the event of threatened compromise. Privacy and cryptographic laws should be formulated and enforced. The government should have the necessary access it might require to track criminal and terrorist organizations. Given the caste stratum of the intellectual capital that would be of value in the Information Age, precautionary measures need to be put in place by the government to ensure that the lower class is offered some measure of protection.

The advent of the Information Age necessitates trickle-down economics, wherein the lower class would essentially be at the mercy of the bourgeoisie classes. While this has traditionally been the character of most third world economies, Nigeria government need to erect policy structures to ensure that it does not lead to an even more unhealthy level of inequality in the distribution of wealth and opportunities. The Nigerian oil industry has a role to play in transforming Nigeria into a digital economy. The industry should make strategic investment in technology in order to improve its productivity. The industry should instill Digital nervous system to improve communication with their costumers, partners and employees. Mundane chores should be automated with web-sites and software. Achieving a paperless office should be one of the primary objectives of Information Technology initiative in the NNPC and its subsidiaries.

Nigerians that worked in the oil industry and have been laid off should pursue opportunities in the technology sector, while the foreign based Nigerians in the high-tech industry need to establish networks amongst themselves. This is exactly how the Indian and the Chinese have penetrated the nooks of high-tech corporate America. Nigerians in the high-tech field need to create opportunities for each other in similar fashion. Given the current focus of many Nigerians, on the need to recognize the architecture of the polity, the geopolitical impact of the Information age on the country cannot be overstated. Nigeria should make the Information Age the seed of its strategic national planning for the 21st century.

Properly regulated emphasis on repairing its brand, privatization of its state-run enterprises, fixing its educational systems and generating phalanxes of skilled high-tech workers would set the country on the road to rebirth.

2.11 MAJOR ISSUES ON THE INFORMATION TECHNOLOGY

The information Technology (IT) has drastically reshaped the Nigeria economy, especially the Nigeria oil industry. In recent years, the IT revolution has created highly skilled IT workers in Nigeria. The information Age affected the way we live, work and play. It is driving the information industry, government, business and consumers increasingly demand communications, computer all software, the Internet, intranets and extranets. Information Technology (IT) has enabled communication network become the predominant means of interaction between individuals, business, organizations and government. While the role of the information industry which include meeting the need for IT products and services remains essentially the same. It is viable, booming, dynamic industry characterized by mergers, acquisitions and consolidation. Driven by high commercial and consumer demand, the industry continues to provide innovative services that enable future growth in other sector. While such high demand places a strain on the ability to influence the market, the information industry remains responsive to supporting the resource requirements.

In spite of instability in the economy of Nigeria, the information industry continues to grow, and foster growth. Whether this growth match the doubt- digit levels depend more on consumer confidence in the overall economy rather than innovation. The IT breakthroughs that have increased productivity in business have the same effect on national security processes. The growing incidence of IT application provided the strategic reserve needed to support surge and mobilization requirements as needed.

This study is of the opinion that the government should partner with industry and academia to resolve the IT workforce. The government should focus on hiring and retraining of IT professional, and should continue to offer bonuses and higher salaries to retain federal IT workers.

To maintain its global leadership in oil supply, the NNPC and its subsidiaries should invest in the IT workforce and ensure that they find the right person with the right skills at the right time .The management of the NNPC need to recognize and support the trend toward life long learning.

Using these technologies by the NNPC and its subsidiaries not only improve the quality of service and cut the cost of services, it also led to the creation of the information society in which the rapid economic growth and employment are expected.

Information and Communication Technology (ICTs) have been identified in this study as powerful means to promote economic growth and social development. It is vital that developing countries respond quickly to this new paradigm otherwise, they might not be in a position to participate in the global economy and improve the standard of living of their citizenry.

ICTs have the potential to create earnings opportunities and jobs, improve delivery and access to health and education, facilities information sharing and knowledge creation, and increase the transparency, accountability and effectiveness of government, businesses and oil industry. By making ICTs an integral and essential component of development, developing countries and their partners can more effectively address economic and social divides. In order to be successful, developing countries, including Nigeria need to develop comprehensive plans and strategies for ICTs adoption and diffusion. They also need to establish reliable ICTs physical infrastructures to meet the expected demands on bandwidth and speeds of communications by the applications and services to be provided under the new paradigm. They also need to adopt measures to ensure equitable access and widespread capacity to make use of ICTs.

Training of people, especially skilled people on (ICTs) technologies are essential. It should start from the elementary school up to the tertiary level. The NNPC and its subsidiaries need to address the capacity gap, to assess, design and implement national ICT for development strategies. Possible strategies include the establishment of research parks. NNPC and its subsidiaries have to work hard to catch with the ICTs wagon. New strategies and plans have to put in place to bridge ICTs divide Countries bridging the digital divide is essential in order to have equal opportunities.

2.12 DEVELOPMENT IN INFORMATION AND COMMUNICATION TECHNOLOGY

With the exponential growth in data and traffic, ICTs Service Providers are suddenly finding out that their real future is in transporting data. The internet and www have moved computing, communications and IT applications in general to the main stream. Such technologies are used on a daily basis in application such as e-commerce, e-business, e-government, e-ticketing etc. The consequence of access to these facilities by unauthorized users ranges from inconvenience to massive loss of money or catastrophe.

The web has also served as a platform for enabling and deploying hundreds of applications, including online stock trading, and banking, e-commerce, e-government, streamed multi-media services and information retrieval services.

The current issues in Information Technology and communications are:

- Security and Authentication
- Quality of Service
- Traffic Engineering
- Standards
- Bandwidth
- Data, Image and Video Compression
- Viruses and worms. (OCED 2003:25)

Securing access to communications and computer system have become an important issue due to increased dependence of individuals and organizations in computer systems and networks to store and communicate data in them. The risk of accessing a computer system or network ranges from inconvenience to catastrophe. Information, Communications and Internet technologies are transforming the world's economy and making the world a global village. These technologies have impacted all aspects of our life. The use of these technologies by public agencies, businesses and private citizen worldwide has grown rapidly. Using these technologies by governments and organizations not only improve the quality of service and cut the cost of services. It also led to the creation of the information society in which the rapid economic growth and employment are expected. Information Communication Technologies are powerful means to promote economic growth and social development. It is vital that NNPC and its subsidiaries respond quickly to this new paradigm, otherwise, they might not be in a position to participate in the global competition and improve the standard of their personnel. It is true that the risks are great, but so are the rewards.

ICTs have the potential to create earnings opportunities and jobs, improve delivery and access to health and education, facilitate information and knowledge creation and increase the transparency accountability and effectiveness of government, business and NGOs. By making ICTs an integral and essential component of development NNPC and its subsidiaries need to establish reliable ICTs physical infrastructures to meet the expected demand on bandwidth and speeds of communications. They also need to adopt measures to ensure equitable access and widespread capacity to make use of ICT. These ICTs and development strategies need to take into account concerns including basic national and global governance issues, market and policies for inclusive growth and among others.

Training of people especially skilled people in ICTs technologies are essential. It should start from the elementary school up to the college level. Developing countries need to address the capacity gap to secure not only a reasonable number of technically qualified individuals but also to acquire the expertise to assess design and implement national ICTs for development strategies. Possible strategies include the establishment of research parks, facilities for companies to conduct research and development with the collaboration of skilled faculty members and graduate students.

It is important to note that the consequences of access to ICT facilities by unauthorized users range from inconvenience to massive loss of money or catastrophe. Governments worldwide have started national programme for research and development of ICTs and Network security. It is important to note that Biometric based authentication techniques have a great potential to improve computer and network systems security due to their high accuracy.

2.13 AN ASSESSMENT OF ENVIRONMENTAL FACTORS INFLUENCING TECHNOLOGY TRANSFER AND ACQUISITION

Since the inception of oil industry in Nigeria, no effective efforts have been made on the part of the government to control the environmental effects of the petroleum industry. This judgment from the Department of Petroleum Resources was borne out of a tangled history of ineffective laws. The most significant of which was the Petroleum Act of 1969 which replaced the original Act of 1916. The Petroleum Act led to the adoption of statutes mandating that the licensee or lessee of an oil exploration or prospecting license or a mining lease adopt all practicable, precautions to prevent the pollution of inland waters, rivers, the territorial waters of Nigeria or the high sea by oil, mud or other harmful fluids or substances. These provisions were highly generalized and lacked specific enforcement mechanisms (Oluwale and Akanle, 1991:65-67).

The oil in Navigable Waters Act implements the 1954 international convention for the prevention of pollution of the sea by oil, restricting discharges of oil into the near shore sea and navigable inland waters. It provided for regulations requiring Nigerian vessels to monitor discharge levels and stipulated fines for violations. While there were some criticisms as to the effectiveness of these regulations, the main weaknesses of the law was that it failed to keep pace with international agreements, notably the 1973 international convention for the prevention of pollution meant to supersede the 1954 convention. The federal Environmental Protection Agency Act reflected the former military government's response to worldwide public demand for legislative mechanisms to protect the environment (Ameze Gubadia, 1993:408). It established the Federal Environmental Protection Agency (FEPA) responsible directly to the president, assigned with the responsibility for the protection and development of the environment and environmental technology, including initiation of policy in relation to environmental research and technology. The Agency advised the government on environmental criteria, guidelines, specific actions or standards for the protection of the nation's air and interstate waters as

may be necessary to protect the health and welfare of the population. From environmental degradation prior to the Federal Environmental Protection Act, there were no definitions for hazardous waters. The 1992 environmental impact assessment decree extended the reach of FEPA in a number of areas including petroleum. The Federal Environmental Protection Agency (FEPA) was mandated to facilitate EIAs, the minimum contents of which were stipulated by law and to ensure the appropriate mitigation steps were taken.

One distinguished Nigerian scholar observed that:

Successive Nigerian governments (military and civilian alike) since Nigeria's political independence have utterly failed, even in the face of an existing legal framework to adequately deal with the nation's environmental problems (Chris Okeke, 1996:37).

Vague language and obsolete provisions weaken the existing legal framework; even this protection was compromised by a lack of enforcement. Enforcement is further complicated by agencies with conflicted interests and competing jurisdictions. The Nigerian law rests regulatory powers over the petroleum industry with the Nigerian National Petroleum Corporation (NNPC). This enables NNPC to become an oil developer (and partner to foreign companies via joint ventures) and a regulator of the industry.

In spite of the environmental constraints in the oil industry, this section of the study reviewed the government policies based on environmental protection of the community and the technological capacity building in the NNPC and its subsidiaries. Assessment of the nature of the transfer and acquisition of oil technology in spite of environmental constraints in the NNPC and its subsidiaries showed that learning of technology was initiated and achieved through the Petroleum Technology Development Fund (PTDF). The Fund provided scholarship for Nigerians to study engineering and technology courses within the country and abroad.

The oil companies supported the development of engineering-based programmes in the Nigerian universities as a result of the Petroleum Decree of 1969. The establishment of the Petroleum Training Institute (PTI) was a major step towards the development of technological capabilities in the oil industry. The result of the training effort and the

accompanying learning experience was the significant changes that occurred in the industry.

Table 2:10 below shows the number of people that have benefited from the Petroleum Technology Development Fund from 1966-2004.

Table 2:10: The Petroleum Technology Development Fund Scholarship 1966-2004

Programmes	1996	1998	2000	2002	2004
Chemical Engineering	13	15	17	19	21
Civil Engineering	9	11	13	15	17
Electronic Engineering	12	14	16	18	20
Mechanical Engineering	11	13	15	17	19
Petroleum Engineering	15	17	19	21	23
Environmental Science	5	7	9	11	13
Geology	8	10	12	14	16
Computer Science	9	11	13	15	17
Surveying	8	10	12	14	16
Accounting	10	12	14	16	18
Management	9	11	13	15	17
Economics	7	9	11	13	15
Geo-Physics	10	12	14	16	18
Natural Gas	12	14	16	18	20
Miro-biology	10	12	14	16	18
Total	148	178	208	238	268

Source: NNPC Annual Report, 2005.

The future of the oil industry perceived to be dependent on the development and upgrading of the technological capabilities, environmental issues and government responses to the technology needs of the oil industry.

2.14 THE EFFECTS OF THE OIL INDUSTRY ON THE ECONOMY OF NIGERIA

There are over 20 multinational oil companies directly and indirectly involved in the exploration and marketing of oil in Nigeria. Some of the companies are Texaco, Mobil, Chevron, Total, ELF and others. Shell Petroleum Development Company (SPDC) is the

largest oil and gas exploration and production company in Nigeria. Shell is also the operator of a joint venture of the Nigeria National Petroleum Corporation (NNPC).

Under the present terms of the memorandum of Understanding between the Federal Government and the major oil companies operating in Nigeria, the oil industry contributed both positively and negatively to the economy through the following:

- Employment
- Transfer of Technology
- Revenue to the Government
- Community Development
- Government Policies
- Industrial Policies

i. **Employment Opportunity**

The oil industry has created a lot of job opportunities for many Nigerians and expatriates alike. It continues to recruit graduates, technologists, technicians as well as unskilled labour. Due to the fact that the salary earned from the oil companies are higher than other companies and government establishment, the wide margin in salary scale led to the workers in other industries to agitate for increase in their salary as they patronize the same market.

ii. **Transfer of Technology**

Transfer of technology has greatly improved the activities of the oil industry and reduced cost. Increased scientific expertise allowed many oil industries to locate and develop further oil fields and computer-aided techniques are becoming an essential feature of day-to-day operation.

iii. **Community Development**

The various oil companies involved in oil exploration in Nigeria are through one way or the other involved in the development of communities near their operation sites. The type of support given to these communities include construction of roads, provision of electricity, pipe borne water, building of clinics/hospitals, school buildings and award of scholarships to indigent and or excellent students.

While the communities appreciated these, they complained that river around the communities were greatly polluted thereby affecting agriculture, which is their major source of livelihood. It is hoped that through this study, the government should look closely at this situation to ensure that useful/relevant supports are given to the communities.

iv. **Government Policies**

The policies governing the oil industry went through many transformations/adjustments. The government should bear in mind that these industries are primarily interested in increasing profit and reducing competition, hence policies should be enacted from time to time according to the need and the situation of the country. These policies should be flexible as much as possible. Indigenous companies also should be encouraged to grow. The creation of Oil Mineral Producing Areas Development Commission (OMPADEC) and the increase in revenues going into the development of oil producing areas is a right step in the right direction.

v. **Industrial Policies**

In order to have and maintain highly skilled personnel, the companies involved in the Nigeria oil industry had for a long time encouraged development of manpower through training schemes. These include on-the-job training for those employed for immediate work in the industry and more advanced technical training in addition to the educational

opportunities available within the country. Moreover, a high number of scholarships, mostly in Nigerian institutes of education were awarded to brilliant scholars to encourage manpower development in the country. Many employees were posted on overseas assignment, where they occupied responsible positions in their sister companies located in other countries.

The NNPC and its subsidiaries have gone through several stages on its way to development. It is very important that the government, oil companies (both indigenous and non-indigenous) and the communities work together to take the oil business to greater heights.

While the oil industries were guaranteed a stable environment for their investments to yield more profit, they should remember that good relationship to the communities are very important.

Onoh (2000:14) emphasizes that NNPC and its subsidiaries have not lived up to expectations of the public. The country with its unlimited potential has been looted into penury. The future looks very bleak, even to its citizens. Many would argue that the country never really existed and was merely an artificial experiment that failed miserably. For many of its people and admirers, emotional detachment has been the safe course to take in order to avoid complete collapse. The study noted that the diversity of the country's resources and a tectonic change in the foundation of the global economy gave reason for optimism in the nation's potential for highly skilled intellectual capital.

It would be difficult to exaggerate the role of NNPC and its subsidiaries to the Nigerian economy. Since the first oil price shock in 1974, oil has annually produced over 90percent of Nigeria's export income. In 2000, Nigeria received 99.6 percent of its export income from oil making it the world's most oil dependent country (FOS 2001).

This study has shown that NNPC and its subsidiaries have profound effects on Nigeria's domestic sector and one way to characterize its impact is by looking at the rents produced by oil, that is, the returns in excess of production costs in the Nigerian economy. From 1970 to 1999, oil generated almost \$231 billion in rents for the Nigerian economy. Since 1974, these rents have constituted between 21 and 48 percent of GDP. These rents have failed to raise Nigerian incomes and done little to reduce poverty.

Nigeria's oil wealth has also led to social and political unrest, particularly in the Niger Delta. The Igbo's effort to secede from Nigeria, which led to the 1967-1970 civil war was deeply rooted in ethnic tensions and Nigeria's colonial past. The unrest among the Ogoni and Ijaw people in the Niger Delta in part can be traced to their desire to win a larger share of the region's economic wealth. The more the states depend on mineral exports, the more they suffer from ethnic unrest. Since Nigeria is remarkably dependent on oil, it has been highly susceptible to these tribulations.

It is important to note that the consequences of access to ICTs facilities by unauthorized users range from inconveniences to massive loss of money. This means that Information, Computer and Network Systems Security are becoming a vital issue in the 21st century. We emphasized that developing countries like Nigeria should work hard to catch up with the ICTs wagon and that strategies have to be put in place to bridge the digital divide between the developing and developed countries as well as within the nation. The review noted that the NNPC and its subsidiaries should install ICTs infrastructure that are reliable and fast in order to attract investment in the field and to facilitate their transfer to the digital world.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter highlights the various methods of collecting and analyzing data for the research study. The study adopted various approaches to generate data for the study.

3.2 RESEARCH DESIGN:

Research in organizations are classified into three main groups (Creswell, 2003,:18) - namely:

- Quantitative Method of Research
- Qualitative Method of Research
- Mixed Method of Research

Quantitative research relies on methods based on cause and effect thinking, reduction to specific variable, hypotheses and questions, use of measurement and observations and the test of theories.

Qualitative research relies on methods based on multiple meanings of individual experiences and historically constructed with the intent of developing a theory or pattern. While mixed method research relies on both quantitative and qualitative methods that are consequences oriented, problem centered and pluralistic (Creswell, 2003,: 18).

In his study, the researcher adopted a combination of the three methods for the collection of data.

3.3 QUESTIONNAIRE DESIGN

Questionnaire were chosen as the most convenient and efficient methods of data collection given that respondents were located at different areas within the country.

First, draft of the questionnaire was developed on the basis of a review of the literature. The contents of the draft questionnaire were discussed with senior executives involved with the study. Each item of the questionnaire was considered, relevant changes were discussed and omissions identified. The amended questionnaire was sent to the respondents who were asked to fill in the questionnaire and give their feedback. The final version of the questionnaire contained a total of 45 questions. It has seven pages long with a cover page of instructions and contained both open and closed format questions. Closed questions required the respondents to rate usually on the basis of 5 point Likert type scale, their opinions on issues relating to the research study. Respondents were not asked for their names. They were informed that only summary statistics would be contained in the study and that no individual(s) would be identifiable. They were asked to give a frank and honest account of their opinions.

3.4 METHODS OF DATA COLLECTION

The primary source of data collection was conducted through survey. Extensive studies were carried out in addition to direct observations, spot assessment of factual information, and collection of data on technical change and technological capabilities of the four NNPC refineries. The secondary sources concentrated on annual reports, audited accounts, engineering reports, memoranda, statistics of NNPC, rolling plans and annual national budget documents.

The survey covered broad aspects of the study namely,

i. Technological Learning:

The survey was directed at the linkages and minor changes capabilities in NNPC, the training effect of NNPC, sponsorships for training in and out of Nigeria, linkages with research and development institutions by specialization and modes of selecting trainees.

(ii) Firm History:

In this case, survey was directed at the investment and production capabilities of NNPC. These included the profile of technology involved in NNPC activities, the schedules of equipment and main assets of the refineries, local technology and fabrication used in the refineries, the proportion of Nigeria's to expatriate staff involved in oil operations.

(iii) The Impact of Technical Change on Performance:

The survey was directed at the major change and strategic marketing capabilities in NNPC and specifically the impact of technical change on production and financial performance.

3.5 QUESTIONNAIRE ADMINISTRATION

The questionnaire was administered in five phases. The first phase concentrated on the NNPC Headquarters at Abuja and the other four phases concentrated at each of the four refineries. During the first phase, questionnaire was administered to randomly selected departments of the NNPC. The questionnaire was pre-tested on some randomly selected samples and necessary corrections were made. The researcher employed simple questions, applying guides and explanations to enable the respondents complete the questionnaire quickly and appropriately.

3.6 INTERVIEW METHODS

The interview methods were used to supplement the questionnaire in order to obtain vital information that could not be gotten through questionnaire. Through personal interview, such information as the firm's manpower size, its historical background, its policy on training and development of personnel were collected. The information obtained from the above exercise enabled the researcher to cross-verify certain answers that were provided by respondents in the questionnaire.

3.7 RESEARCH POPULATION

The total workforce of the Nigerian National Petroleum Corporation (NNPC) and its Subsidiaries formed the population of the study. Available record put the staff strength at 10,000 personnel (NNPC Annual Report, 2005).

3.8 SAMPLE SIZE DETERMINATION

Determining the appropriate sample size for an investigation of this study was an essential step in the statistical design of a project. Performing a valid sample size calculation required estimate of the variability in the data as well as defining the effect size sought or the desired precision, the allowable error rate and a planned method of analysis. An adequate sample size ensured that the study yield reliable information. The sample size from this study was determined by adopting the Taro Yamani formula as expressed below:

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

Where n = Sample Size

N = Population size

e = margin of error

The researcher adopted five percent (0.05) as the margin of error.

$$\begin{aligned} n &= \frac{10,000}{1 + 10,000 (0.05)^2} \\ &= \frac{10,000}{1 + 25} \\ &= \frac{10,000}{26} = 385.61 \end{aligned}$$

The sample size for this study was rounded to three hundred and eighty six respondents.

The researcher adopted simple random technique where each member of the respondents had the same chance of selection.

3.9 METHODS OF DATA ANALYSIS

Data collected from the study was classified into different groups with the aid of tables. The data presented using statistical tools like percentages, histogram, bar charts and pie charts to facilitate easy interpretation. The chi-square analysis and the analysis of variance (ANOVA) were used to test the hypotheses, while the multivariate probit analysis was used to estimate how much the quality of ICTs infrastructure affects e-mail, web and computer use in the NNPC and its subsidiaries.

3.10 INSTRUMENT VALIDITY AND RELIABILITY

The essence of establishing the validity and reliability of the research instrument was to ensure that the instruments objectively measure what it seeks to measure. In this case, validity is the extent of which the information represents that it intended to represent.

In this study, the pilot study technique was adopted to establish the validity of the questionnaire. The pilot test involved face to face interview with the respondents to gather constructive feedback. Based on their input, adjustments were made to remove ambiguity.

On the other hand, reliability implies consistency in measurements. The test and re-test methods were used to determine the reliability of the questionnaire. Crombach Alpha coefficients were computed to test the reliability of the instruments. The calculated alpha coefficients fell within the range of 0.70 to 0.90.

In the course of the study, the researcher visited the refineries sites to observe the plant and its personnel. Information were collected on the refinery process, the various components of the plant and the functionally organization of NNPC. The researcher studied files, reports, memoranda and other sources of information about the refineries to identify technical changes. Senior, junior and long serving personnel were interviewed

about their recollections on technical changes. Personnel with essential roles including engineers, accountants, managers, technicians and scientists were interviewed to determine the nature of their duties and the ability of NNPC and its subsidiaries to perform such assignments.

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CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

The impact of computers and the Information technology that accompanied them have a huge impact on the way organizations of all types and sizes do their work (Solomon, 1989:167-170). What became known as the Information and Communication Technologies (ICTs) revolution has improved efficiency and effectiveness in most sectors of the economy (UNCTAD, 2002:14-16). By allowing organizations to create and analyze important new information, it changed the way many decisions were made (Osunbor, 1999:23-25). In both business and government, the growth of the Internet and its related software have spawned new ways of conducting business. This chapter analyses the results of the investigation affecting the adoption and diffusion of information and communication technologies (ICTs) in NNPC and its subsidiaries.

The analysis looked at;

- How much and what kind of ICTs were used by the managers of NNPC and its subsidiaries
- Factors associated with different patterns of ICTs use
- The extent to which the managers/staff are satisfied with ICTs use in their organizations
- What led to the use of ICTs in the recruitment and management of NNPC and its subsidiaries

4.1.1 The Research Process

The researcher asked the managers and staff of the NNPC and its subsidiaries to respond to questionnaire dealing with ICTs related matters. The questionnaire was based on earlier interviews, pilot tests and a review of the relevant literature.

The data for this study came from four main groups of respondents: The first group, staff from NNPC Headquarters at Abuja, the second group from the respondents from Port

Harcourt Refinery and Petrochemical Company, third group from the respondents from Warri Refinery and Petrol-chemical Company, and the fourth group from Kaduna Refinery. All together, we distributed 400 copies of questionnaire and 386 respondents were used with a response rate of 96 percent. We noted that these respondents were considered a representative sample of all staff of the NNPC and its subsidiaries as stated in chapter 3 of this study. In spite of certain limitations, the total sample used in this study represented a diversity of firms in terms of their location, organization size, mission and number of staff as shown in table 4.1

Table 4.1 Geographic distribution of the sample

Location	Frequency	Percentage
NNPC Headquarters Abuja	138	35.75
Port Harcourt Refineries 1 & 2	102	26.42
Warri Refinery	82	21.24
Kaduna Refinery	64	16.58
Total	386	100

Source: Survey data

4.1.2 ICTs use by Managers and Staff of the NNPC and its Subsidiaries

For the purpose of this study, Information and Communication Technologies (ICTs) are divided into three categories (Roger, 1995:45-47):

- i. **Hardware:** the equipment or machines that facilitate information and communication and communications processing including perusal communications processing including perusal computers, fax machines, cellular phones and handheld computers.
- ii. **Software:** the programmes that are used to run the hardware

- iii. **Internet and Applications:** the network infrastructure that is used to facilitate communications via e-mail, Internet searching, and the transfer of information using web sites.

This section of the study evaluated the factors associated with ICTs use in the NNPC and its subsidiaries. From the analysis, we found that there were considerable variations in ICTs use among the different kinds of staff represented in the study. Further research would explore whether these factors have a cause- and-effect on ICTs use or whether they were due to some other influences.

In this study, factors that were related to ICTs use pattern were grouped into three categories (Ndukwe, 2003:34-36), namely;

- i. **Individual characteristics of managers:** In this case, we examined whether male managers more or less likely to apply ICTs than female managers to determine differences associated with the level of formal education achieved by managers. We also examined the amount of prior experience they have with computers or the amount of time they have been in the profession.

- ii. **Organizational Characteristics, such as size and mission:** In this case, we looked first at how ICTs use patterns varied between organizations (NNPC Headquarters and Refineries)

- iii. **Staff Programme Characteristics:** This refer to the overall size of the programmes and its relative size within the organization as measured by the size of its budget relative to the overall organizational budget. We examined also factors within staff programme that affected use patterns, such as how much of the programmes budget was allocated to ICTs, how much technical support was provided for ICTs and the extent to which there were explicit policies and guidelines established for ICTs use.

Details on how the above factors were defined and measured are shown below

Table 4.2 ICTs Tools (Hardware)

ICT TOOLS (HARDWARE)			
One Type	Two types	Three Types	Four Types
PC or Fax machine	PC and Fax machine	PC and Fax machine	PC and Fax machine
Cellular Phone	Cellular Phone	Cellular Phone	Cellular Phone
Hand held Computer	Hand held Computer	Hand held Computer	Hand held Computer

Source: Survey data

Table 4.3 Potential Factors that influence ICTs Use**Individual Level**

Sex	Male		Female	
Education	University Degree			No University
Computer skill	Poor	Fair	Good	Excellent
Computer Experience	Less than 5 years More than 10 years	5 ó 10 years	11 ó 15 years less than 100 years	Greater than 15 years
Job experience	Less than 5 years	5 ó 10 years	10 ó 15 years	Greater than 15 years

Source: survey data

Table 4.4**Organizational Level**

Organization Type	NNPC Headquarters	P.H. Refinery	Warri Refinery	Kaduna Refinery
Total Budget size of the organization	Greater than ₦750,000.00	₦120,000.000 to ₦140,000,000	₦101,500,000 to ₦150,000,000	₦100,000,00 to ₦140,000,000

Source: survey data

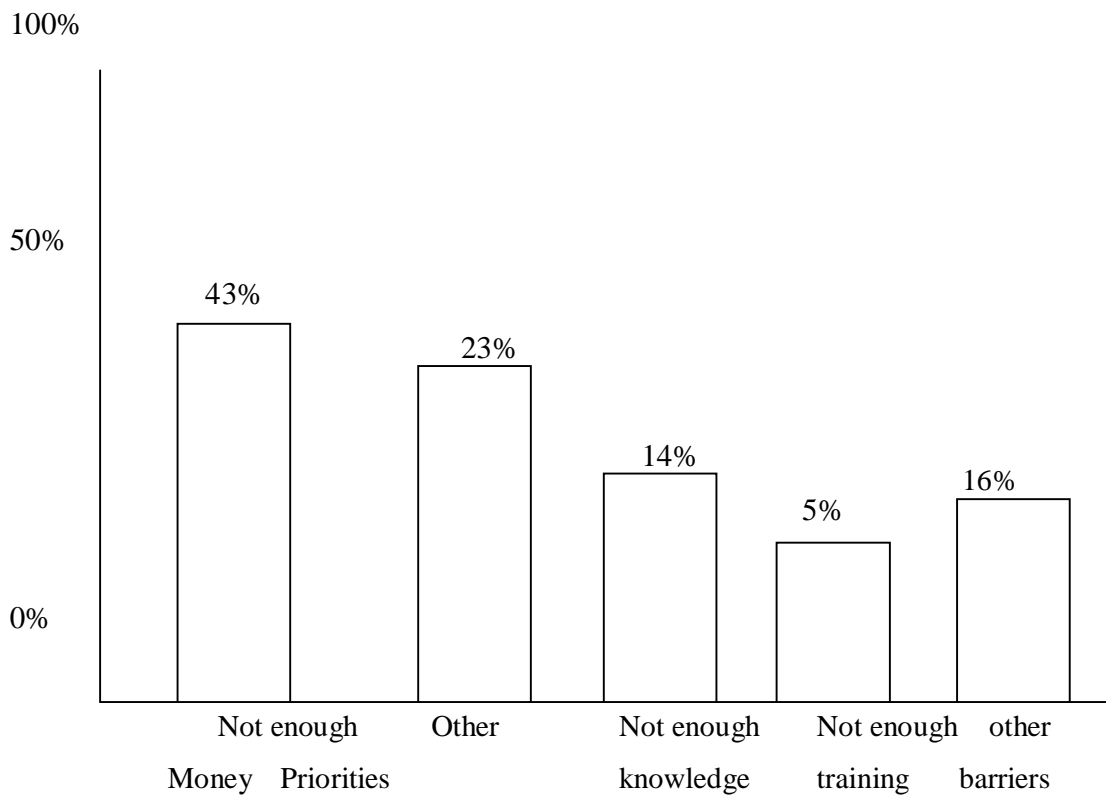
From the study, we found that the factors that correlate to ICTs use was the size of the staff programmes budget relative to the size of the organization's total budget. Staff programmes that received more than 10 percent of their organizations' total budget had more interactive web sites and more ICTs tools and used ICTs to communicate more personalized messages. This analysis suggested that the size of staff programme budget

reflect the importance that the organization's leadership places on its staff programme. A programme that was considered important received more funding and it more likely to get the most out of whatever ICTs have to offer.

4.1.3 Perceived Barriers to ICTs Use

Respondents were asked to identify what they perceived as the main barriers to increasing the amount and variety of ICTs use in their programmes. As shown below.

Perceived barriers to ICTs use



Source: Survey data

The most commonly reported barrier was 'not enough money' identified by 43 percent; second was other priorities by 23 percents. Interestingly, few respondents reported lack of knowledge or training in ICTs matters as barriers. This suggested that many would be willing to make improvement to the way they use ICTs if they had the time and money.

4.1.4 Satisfaction with ICTs

We asked respondents about their general satisfaction with ICT use and about their satisfaction with e-mail, the Internet. We also asked them to indicate how much and what kind of impact they thought ICTs have on the programmes in terms of cost, efficiency, productivity and quality of service delivery.

Though, none of the respondents was profoundly dissatisfied with the amount of ICTs used in their organization. The status quo was a preferred option for most respondents.

In terms of satisfaction with e-mail, 95 percent of respondents said that e-mail was useful or very useful. When asked what they liked about it, they identified its speed, convenience and efficiency. The respondents saw e-mail more as an informal information-sharing tool than as a means to build or solidify relationships through personalized communication, that is, as a way of building commitment or team spirit, over half of the respondents reported that when they search the internet, they found the information they needed more than 75 percent of the time.

4.1.5 Perceived Impact of ICTs on staff Programmes.

To get some idea of the impact of ICTs on staff programme, we asked respondents to rank the extent to which ICTs use in their training programme had resulted in cost reductions or increases in efficiency, productivity or service quality. We rated these items using a five-point scale that ranged from large extent to not at all.

Overall, the results suggested that the impact of ICTs on efficiency, productivity and service quality was greater than the impact on cost. Approximately two-thirds of respondents reported that ICTs had a moderate to large positive impact on efficiency and service quality.

4.1.6 How can ICTs Use Be Improved

Respondents were given list of possible changes they could make in applying ICTs to their staff development programmes. The results are shown in table 4.5 below

Table 4.5: Possible Improvements to staff programme through application of ICT

		NNPC Headquarters	Port Harcourt Refinery	Warri Refinery	Kaduna Refinery
i.	Interactive web site	32(23.2%)	21(20.5%)	18(21.95%)	15(23.4%)
ii.	More staff Internet access point	28(20.3%)	18(17.6%)	15(18.29%)	12(18.75%)
iii.	More training	23(16.7%)	15(14.7%)	13(15.85%)	10(15.63%)
iv.	More technical assistance	18(13%)	17(16.7%)	10(12.2%)	6(9.38%)
v.	Newer computer	12(8.7%)	12(11.7%)	9(10.98%)	5(7.8%)
vi.	Internet access	10(7.2%)	9(8.8%)	6(7.32%)	7(10.94%)
vii.	More staff e-mail account	15(10.7%)	10(9.8%)	11(13.42%)	9(14.06%)

Source: survey data

Respondents from the NNPC headquarters and the three Refineries chose same changes as their top four, but ranked them in slightly different order.

The top four areas for ICTs improvement were

- Interactive web site
- More staff Internet access points
- More training and
- More technical assistance

Two of these, namely more interactive web site and more staff Internet access point relate to enhanced usage. The other two have to do with customizing applications to meet the needs of staff programmes.

4.2 PROFITABILITY ANALYSIS

In the course of this study, factors that enhanced profitability were considered in measuring the impact of ICTs adoption on the fortunes of the NNPC and its subsidiaries.

These factors include:

- Cost of ordering (processing)
- Raw materials and other inputs

- Inventory keeping
- Other product costs

The refineries although operating at below capacity recorded enhancement of profit level since the adoption of ICTs than before, as a result of significant savings in cost of ordering raw materials and other inputs.

Ordering of raw materials (processing) and other inputs before the advent of information technology was done manually, involving a lot of paper work and personnel to physically follow-up materials. This led to machine down-time and wastage of human resources which ultimately added the cost of production.

However, with the adoption of ICTs by the refineries, ordering has been made less laborious and time drastically reduced through the use of computers and telephones, fax machines and e-mail transactions. The adoption also reduced the cost of product in the sense that the use of computers facilitated product verification and quality control, which in the past had taken time to accomplish, thereby adding to the product cost. This assisted the refineries to keep inventory of raw materials at a reasonable level thereby minimizing other effects. This helped to avoid unnecessary high inventory build-up. Analysis of data collected revealed that the levels of these factors in the refineries during the pre-adoption period of ten years (1970-1980) were on the average about 57 percent. This indicates that the period before the adoption of ICTs in the refineries, these factors put together accounted for as high as 57 percent of cost of operation. Details of the factors considered and the average rate of contributions are shown in table 4.6.

Table 4.6: Profitability level in the Refineries Before/after ICTs Adoption

Production	Pre-Adoption %	Post-Adoption %
Raw materials ordering cost	16	14
Cost of sales	20	15
Inventory costs	13	10
Product cost	8	6
Total contribution to operating costs	57%	45%
Contribution to profit margin	12%	

Source: Ssurvey data

From the analysis, it was found that when the adoption of ICTs reached a significantly high level in these refineries, the proportion of these factors in total cost of operation was reduced by as much as 12 percent from 57 percent to 45 percent. This implied that profitability of the refineries was enhanced by an average of 12 percent per year as a result of adoption of ICTs by the refineries. In other words, it could be concluded that the adoption of ICTs increased the profitability prospects of the refineries by as much as 12 percent.

4.3 ANALYSIS OF OPERATIONAL EFFICIENCY

The mode of measuring efficiency was quantitative to the extent that the staff in the refineries were asked to respond in the affirmative or otherwise, if the adoption of ICTs had in any way improved their operational efficiency. Details of the rating are shown in table 4.7

Table 4.7: impact Analysis on Operational Efficiency

Operational Indices	Port Harcourt Refinery (%)	Warri Refinery (%)	Kaduna Refinery (%)
More effective use of time	42	34	24
Increased productivity	44	36	20
Higher product and service quality	38	34	28
Increased revenue	43	32	25
Diversified product mix	40	33	27

Source: Survey Result

The adoption of ICTs as shown in table 4.7 resulted in increased productivity in Port Harcourt and Warri Refineries (44%, and 36%) respectively, whereas the adoption of ICTs resulted to higher product and service quality in Kaduna refinery to the tune of 28 percent with respect to 38 percent and 34 percent respectively in Port Harcourt and Warri refineries. In all these instances, the impacts had in quantitative terms not less than 18 percent increase in efficiency over what was obtained before the adoption of ICTs.

4.4 ANALYSIS ON THE IMPACTS ON INVESTMENT

We expected that the adoption of ICTs by the refineries would result in new investment, which no doubt would have remarkable multiplier effect on the economy. The analysis revealed that the adoption of ICTs stimulated substantial investments in the refineries in the areas of acquisition of new and modern equipments upgrading of existing facilities and the development of adequate facilities.

Table 4.8 Investment Analysis on ICTS facilities

Investment (N'million)	Port Harcourt Refinery (%)	Warri Refinery (%)	Kaduna Refinery (%)
Less than 1 million	12	10	26
1-10 million	25	28	21
11-50 million	36	40	33
51-100 million	20	28	9
Above 100 million	7	4	11
Total	100	100	100

Source: Survey Result

As shown in table 4.8, 36%, 40% and 33% percent of the Port Harcourt, Warri and Kaduna refineries respectively invested up to 50 million Naira in ICTs facilities. We observed that these investments were mostly in hardware, software and other infrastructural facilities.

4.5 IMPACT ANALYSIS ON CAPITAL UTILIZATION

Low capacity utilization, which for sometime had become a perennial problem to the refineries sub-sector had been attributed to turn-around maintenance and raw material availability. Indications were that ICTs adoption had contributed significantly to closing of communication gaps, as users and suppliers now communicate more easily and faster through electronic mail (e-mail).

Analysis of data on table 4.9 shows that the adoption of ICTs by the refineries has changed the operating horizon in terms of utilization of their capacities.

Table 4.9 Impact Analysis on capacity utilization

Investment (N'million)	Port Harcourt Refinery (%)	Warri Refinery (%)	Kaduna Refinery (%)
Less than 10	10	13	15
11 - 20	12	10	11
21 - 30	18	14	13
31 - 40	15	12	16
41 - 50	20	22	20
Above 50	25	30	25
Total	100	100	100

Source: Survey Result

The analysis indicates that between 25%, 30% and 25% respectively in the respondents working in the refineries indicated the ICTs adoption led to an increase in their capacity jump in their utilization by more than 50% over what it was before adoption. Between 20%, 22% and 20-% respectively of the respondents from the refineries experienced increases in capacity utilization. Interestingly, none of the respondents indicated negative or stagnant capacity utilization as a result of ICTs adoption.

4.6 IMPACT ANALYSIS ON CAPACITY BUILDING

Contrary to fear often expressed that adoption of modern information and communication technologies might lead to job losses, the opposite was found to be the case. Rather, it opened more opportunities not only for employment of more staff, but also for training and retraining of existing staff in the mastery of the new and sophisticated equipments.

The employment profile of NNPC and its subsidiaries in ICTs according to the respondents are shown in the table 4.10 below.

Table 4.10 Employment profile in ICTs

Category	NNPC Headquarters	Port Harcourt Refinery	Warri Refinery	Kaduna Refinery	Total
Management staff	42	22	23	13	100
Senior staff	60	46	34	34	174
Junior staff	36	34	25	17	112
Total	138	102	82	64	386

Source: Survey Result

The attempt to build up adequate capacity in ICTs to the NNPC and its Subsidiaries has updated the knowledge of their ICTs staff by providing training opportunities in relevant areas which include the following:

- Database management programme

- Computer appreciation
- Word processing
- Spreadsheet (Excel)
- Operating systems
- Systems Administration
- Financial management

The analysis showed that as many as between 90 and 95 percent of the respondents agreed that training received was relevant and effective. It followed therefore, that between 80-90 percent of the staff acquired the capability to render services in house. The adoption of ICTs in the NNPC and its subsidiaries has been of tremendous benefits to the Nigerian economy. These benefits according to the respondents are given in table 4.11 below.

Table 4.11 Benefits Derived from ICTs Adoption

Benefits	NNPC Headquarters (%)	Port Harcourt Refinery (%)	Warri Refinery (%)	Kaduna Refinery (%)
Lead to increase productivity	10	13	12	10
Provides better recording	9	8	9	8
Provides more timely and accurate information	13	12	10	11
Provides better financial control	11	7	8	7
Improved operations procedures	12	14	13	11
Provides better Accounting systems	10	8	9	10
Speed up Decision-making process	11	10	9	12
Provides better communication network	9	11	12	10
Facilitates growth	7	8	10	11
Increase in Research activity	8	9	8	10
Total	100	100	100	100

Source: survey Result

4.7 FACTORS AGAINST ICTs ADOPTION

Majority of the respondents were in agreement with the fact that irregular power supply poses the greatest constraint to the level of adoption of ICTs in the NNPC and its subsidiaries. Detail analyses are shown in table 4.12

Table 4.12 Constraints in the Adoption of ICTs

Constraints	Strongly Agree				Disagree (%)					No Option (%)			
	NNPC	Port-Harcourt	Warri	Kaduna	NNPC	Port	Harcourt	Warri	Kaduna	NNPC	Port	Harcourt	Warri
Irregular Power Supply	58	51	56	54	36	40	39	38	38	6	9	5	8
Lack of training opportunity in IT	44	41	52	51	51	46	38	34	34	4	13	10	15
Lack of in-house experts	25	32	38	34	48	44	42	45	45	27	24	20	19
Lack of capability with existing systems	36	32	38	34	49	46	42	43	43	15	22	20	23
Lack of vision and support by top Management	28	38	36	33	39	35	39	34	34	33	27	25	23
Lack of technical Information and Concerning specific and appropriate technologies	23	29	32	36	44	42	43	41	41	33	29	25	23

Source: Survey Result

4.8 ANALYSIS ON RESPONSES BASED ON INTERVIEW QUESTIONS

4.8.1 Interview Question 1: What are the Training needs in Information Technology in the Oil Industry?

The researcher gathered through the interview of the respondents that their training needs in IT included getting the staff well-equipped where it is expected that electronic management of documents might eventually take over the operation and making training in IT inevitable. The respondents indicated that the training enabled the staff to serve the industry better. The training made the parent industry and the entire nation more aware of technological innovation.

4.8.2 Interview Question 2: What are the different methods adopted for training in the Oil Industry?

The researcher gathered that in the oil industry, it was unanimously agreed that there exist two types of training, namely formal and on-the-job training. Formal training or off-the-job training involved practical courses on specific topics in a developed programmed for new conceptual, analytical and problem solving skill, whereas, on-the-job training was based on basic training methods where a trainee was shown the ways job could be done through instruction and supervision.

4.8.3 Interview Question 3: Are there differences between the training patterns adopted for staff in the different refineries?

The respondents admitted that there exist different forms of training adopted in their particular industries from others, since their goals, objectives and policies were not the same. In terms of differences in their methods of training, Warri Refinery and Petrochemical Company used both internal and expatriate consultancies. In each case, there exist provisions of trainees' packages/ materials which the trainees could refer to after the training session, but their quality, quantity and types vary between the different refineries.

Another area was the training on specific computer software packages used in the refineries. All of them store information on the hard disc, but still use specific package depending on the job functions of the particular refinery and what the firm wants.

4.8.4 Interview Question 4: How effective are the existing training efforts in these refineries?

The researcher gathered that the quality of the staff affected the effectiveness of the training efforts because all levels of staff were trained. It was observed that training was not confined to a particular category of staff. The respondents declared the training programmes as effective, motivating and efficient.

4.8.5 Interview Question 5: What are the Merits and possible solutions to problems encountered in training staff in IT in the oil industry?

In the course of this study, it was established that training was designed to improve performance on the job. All the staff that was employed without knowledge of computer application became computer literate. It was also noticed that among workers of the oil industry have traveled outside Nigeria to acquire computer knowledge. Personnel operations have become more efficient and effective, staff knowledge became upgraded and more skills were acquired. We noticed the problem of inadequate funding, poor maintenance culture and lack of basic infrastructure.

4.9 IMPACT OF TECHNICAL CHANGE ON NNPC PERFORMANCE

4.9.1 Production Performance

The oldest of Nigeria's refineries was located at Alesa Eleme near Port Harcourt, River state. The refinery was commissioned in 1965 and built with in initial crude processing capacity of 35,000 barrels per stream day (BSPD). It was primary to produce fuel for domestic transportation, gasoline and diesel fuel. The products of the refinery included liquefied petroleum gas (LPG) and kerosene. The decision to establish the refinery followed the discovery of oil in commercial quantity in Nigeria. The federal government decided in 1954 that when daily crude oil production in Nigeria reached 50,000 BPSD,

the construction of a variety would be inevitable. This target crude production level was actualized in the 1957 preliminary surveys around Port Harcourt. Shell BP Petroleum Refinery Company was commissioned to construct and run the refinery at Eleme. Later in 1962, the government acquired 50% equity holding in the 35,000 BPSD Refinery (World Bank, 1998). This prepared way for the incorporation of the Nigerian Petroleum Refinery Company limited. The refinery met domestic petroleum demand for petroleum product. After the civil war, the refinery was rebuilt with a production capacity of 60,000 BPSD (World Bank, 1998). Following the rapid industrial growth and the increased economic activities in Nigeria, premium gasoline and gas recorded about annual average growth of 30 percent. Acute fuel shortages of the early 1970s compelled the government of Nigeria to refine Nigeria crude abroad in Rotterdam and later re-import the refined petroleum to the country to serve domestic fuel needs. This development paved way for the establishment of a second refinery in Nigeria. This was the Warri refinery established in 1978 to process two types of Nigeria's crude oil. These were the NNPC and shell Ughelli control center crude and the NNPC and Gulf Escravos crude oil. These crude brands were blended in the ratio of 7:3 with a crude distillation unit of 100,000 barrels per stream day. The refinery operation at full capacity was designed to produce the products shown in table 4.13

Table 4.13 Petroleum Products Daily production

Petroleum Products	Daily production (tons)
Fuel gas	306
LPG propane	187
LPG Butana	459
Gasoline	5015
Dual purpose kerosene	2380
Automatic gas oil	4522
Fuel oil	3808

Source: NNPC Annual Report 2000

The operations of two refineries (Port Harcourt and Warri) did not produce adequate supply of refined crude for domestic consumption. Hence the Kaduna refinery was established in 1981. The refinery was to process both high and heavy crude from domestic and external sources. The lubrication plant of the Kaduna refinery processes imported heavy crude (Paraffin-based) for producing lubricating oils, bitumen, asphalt, sulphur, waxes and greases. With the third refinery total refinery capacity reached 260,000 BPSD. However, demand-supply balance showed that demand for refined products outstripped supply from the three refineries throughout the 1970s and late 1980s. The demand- supply imbalance led to the expansion of the installed capacity of the Warri and Kaduna refineries. The Kaduna refinery was expanded from 100,000 to 110,000 BPSD, while the Warri refinery was expanded from 100,000 to 125,000 BPSD (NNPC Annual Report 2000).

Table 4.14 Installed capacity of the refineries

Refinery	Installed Capacity	Operating capacity Barrels/day
PHRC (old)	60,000	N/A
PHRC (New)	150,000	120,000
WRPC	125,000	100,000
KRPC	110,000	80,000

Source: NNPC Refinery Report, 2000.

Furthermore, as the domestic demand for petroleum products increased beyond the production capacities of the existing three refineries, the government embarked on the construction of a fourth refinery operated with a processing capacity of 150,000 BPSD and was designed to process fuel in order to end fuel importation and create opportunities for exports. The fourth refinery combined with refining capacity of Nigeria refineries was about 445,000 BPSD.

4.9.2 Financial Performance

In the course of this study, we observed that the NNPC finances were closely related to that of the federal government. The NNPC export revenues were reflected in the central Bank of Nigeria account, jointly controlled by the government and the NNPC. The government decide how much of this revenue to be passed on to the federation account, also decide the amount to be allocated to the NNPC in the form of cash calls in order to cover upstream obligations of the NNPC joint venture companies and how much to be directed to priority investments by means of dedicated oil accounts. The main source of financing for the NNPC is the cash calls. The cash calls are funded from offshore petroleum export revenues.

Furthermore, petroleum refining offers the NNPC and the federal government, another source of revenue. Other resources of funding for NNPC include dedicated accounts, budgetary allocations from the federal government, external loans and occasionally the sale of equity. Extra budgeting allocations from oil revenues to NNPC were established in about six dedicated accounts. These accounts are set up to earmark revenues for special projects, which include:

- An account for NNPC
- An account for NNPC liquefied Natural Gas Project.
- A fund managed by the Central Bank of Nigeria on behalf of the presidency.
- A loan recovery fund
- Solid mineral fund
- A strategic reserves fund

Table 4.15: NNPC Capital Investment (1995-2000) (₦billion)

Investments	1995	1996	1997	1998	1999	2000
Upstream Exploration and production	20,207	30,971	48,625	62,616	72,857	71,800
i. Petroleum	18,634	38,380	45,687	60,368	70,448	69,391
ii. Joint Ventures (Cash calls)	18,464	38,196	44,832	52,933	66,988	68,701
b. NNPC	169	184	855	1,135	3,459	690
Geophysical	26	42	0	N/A	N/A	N/A
Gas (LNG)	1,547	2,530	2,938	2,248	2,409	2,409
Downstream Project	4,990	14,630	12,224	15,278	17,295	5,209
i. Eleme Petrochemicals	2,297	7,871	7,179	4,608	1,192	30
ii. Refinery Repairs	313	1,233	297	697	1,378	456
iii. Product Distribution	191	3,082	3,702	2,431	2,724	824
iv. Gas supply	763	856	452	281	829	277
v. Infrastructure	319	667	505	1,356	1,615	1,276
vi. Priority Projects	N/A	N/a	N/A	6,138	6,860	1,567
vii. Laboratory Equipment	13	9	44	N/A	N/A	N/A

Source: Federal Government of Nigeria, NNPC Report 2002.

The above figures show that NNPC capital investment targets in both the upstream and downstream have continued to increase total investment increased from N24,892 to N60,894 billion in 1995 and 1997 respectively. Between 1999 to 2000, it declined from N98,990 to N83,985 billion. This was caused by drastic cuts in downstream investment in 2000.

Downstream investments were targeted at 17 priority projects valued at N14,567 billion. These projects were listed among NNPC priority projects. Investments decisions were not taken by NNPC. NNPC and its subsidiaries could not perform as creditable as they would because the federal government before, the deregulation took pricing and investment decisions. Attempts to increase investment funding from the oil revenues would also reduce government expenditure.

4.10 ANALYSIS OF DIFFUSION THEORY AND INFORMATION TECHNOLOGY

Diffusion is defined as the process by which an innovation is adopted and gains acceptance by member of a certain community (Okebukola, 1997:35). Recognizing the potentials of Information and communication Technologies (ICTs) to transform development, it is clear that the NNPC and its subsidiaries benefited much from the information revolution as this study revealed.

While the impact of the information revolution is tremendous, the existing infrastructure, socio-economic, cultural and political situations poses major difficulties in introducing, implementing and diffusing the new technologies for inter-networking. This study indicated clearly that the ICTs adoption in the NNPC and its subsidiaries created new jobs and new employment opportunities.

Many young graduates from Nigerian Universities and polytechnics have been re-trained in ICTs in order to make them globally competitive to create new wealth in such areas such as software development, e-technology, e-commerce, etc. Nevertheless, there are several impediments to the successful use of information and communication technologies (ICTs) in the NNPC and its subsidiaries as revealed by this study. These impediments include cost, weak infrastructure, lack of relevant software and most cases limited access to the Internet.

Generally in Nigeria, a formidable obstacle to the use of Information and communication Technologies are infrastructural deficiencies. Computer equipment was made to function with other infrastructure such as electricity under controlled conditions. For the past years, the Power Holding Company in Nigeria has been having difficulties providing stable and reliable electricity supply to every nook and cranny of the country without success. Currently there is no area of the country, which can boost of electricity supply

for 24 hours a day, except probably areas where government officials live. There have been cases whereby expensive household appliances such as refrigerators, deep freezers and cookers have been damaged by upsurge in electricity supply after a period of power outage. Electronics equipment, notably radio, television, video recorder and even computers, has been damaged during irregular power supply. When electricity supply is not stable and constant, it is difficult to keep high tech equipment such as computers functioning, especially under extreme weather conditions as obtained in Nigeria, hence made electronic equipments to have short live.

Another obstacle identified in the application of ICTs was the lack of relevant software availability. There is no doubt that the ultimate power of technology is the content and the communication. This study revealed that there exist discrepancy between relevant software and demand in Nigeria.

Solomon (1989:65-67) points out that there exists clear indication that in many countries the supply of relevant and appropriate software is major bottlenecks obstructing wide application of the computer.

The following major areas suggested the range of applications that computer can serve the oil industry. First, computer could enhance production efficiency. The efficiency in various production systems could be improved. Second, computers could facilitate administrative functions. Examples include their uses for budget planning, accounting for expenditure, writing correspondence and reports. Third, computers could change current pedagogical practices in the training centers, It is universally accepted that computers allowed more independent exploration, more personally tailored activities, more teamwork and more significantly less didactic instruction (Smith, 1989:28-30).

4.11 ANALYSIS OF LOCAL TECHNOLOGY AND FABRICATION USED IN THE REFINERIES

The occurrence of technical change in NNPC was observed in the local Technology and Fabrication used in the Turn Around Maintenance (TAM) operations in the refineries. This study revealed that the petroleum Training institute (PIT) located near Warri designed and constructed a five tons overhead crane used for moving heavy machinery in the refineries and the workshops, a prototype mechanism of the blower used for raising and lowering burner buckets in the refinery, a crude-treater for emulsion crude at the refineries multi-purpose centrifugal blower, lubricant filling machine and a modified wheel-barrow.

The indigenous oil service companies mainly provided other local technologies used in the oil industry. These technologies consist of the design and fabrication of maturing stations for oil companies calibration of oil tools and instruments such as flow meters, prone loops and furnace for melting steel and alloys. Table 4.16 shows a rather laudable increase in the number of Nigerians working in the oil industry. The various operations are categorized according to labour and skill.

The table shows that most Nigerians employed in the oil industry operations are involved mainly with managerial, clerical and general labour (skilled or unskilled). Most of the professionals were drawn from expatriates working with Nigerian engineers. The main projects of the NNPC are largely aimed at repairs of existing refinery facilities and the construction of pipelines and petroleum depots. At the same time, the aim of Turn Around Maintenance (TAM) programmes of the refineries was to reduce shut down due to failure of equipment or plants. TAM aimed at increasing efficiency and improving performance. This is not so with Nigerian refineries, because TAM programmes were not done on schedule due to lack of funds, appropriate spare parts, corruption and political interference in the investment decision of NNPC.

Table 4.16 Proportion of Nigerian Staff involved in Oil Sector Operations

Year	Management	Profession	Intermediate Supervision	Clerical	Skilled Labour	Unskilled Labour	Total
1995	165	127	238	248	227	193	1198
1996	170	134	235	220	209	138	1106
1997	175	138	225	210	198	90	1036
1998	175	138	202	184	162	62	923
1999	186	148	194	175	146	57	906
2000	186	149	193	168	138	48	882
2001	186	158	194	166	133	39	874
2002	184	153	174	158	129	34	832
2003	182	148	155	144	108	32	769
2004	176	149	152	140	90	30	746
2005	173	148	153	143	88	23	728
Total	1968	1590	2115	1953	1628	746	10,000

Source: NNPC Annual Report, 2006

4.12 ANALYSIS OF INFRASTRUCTURAL REQUIREMENT IN THE REFINERIES

Ranking on a scale of 1 to 5 for least important to most important, the respondents in the refineries gave adequate supply of electricity, as an indispensable infrastructural facility required for high adopting level of ICTs, closely followed by telecommunications equipment facility. Educational institutions for effective training for ICTs experts and availability of computer facilities were also rated high among the necessary infrastructural facilities.

In the opinion of the respondents, the underdevelopment of these infrastructural facilities has been largely responsible for the low level of adoption of ICTs. The ranking order is presented on table 4.17.

Table 4.17 Infrastructural Facilities to enhance ICTs Adoption in the Refineries

Infrastructural Facilities	Port Harcourt Refinery (%)	Warri Refinery (%)	Kaduna Refinery (%)
Adequate power supply te	31.4	31.7	28.13
Telecommunication equipment	27.5	25.6	23.44
Training and Educational Institutions	23.5	17.1	20.31
Modern ICT Systems Computer Laboratory for Research into new technology	6.8	10.97	12.5
Total	100	100	100

Source: Survey Result.

Other opinions offered by the respondents as necessary factors that might expand the adoption of ICTs include:

- * ICTs components should be made available at moderate costs.
- * Government to make funds available for local development of ICTs component and parts.
- * Focus on manpower training in ICTs.
- * Deregulation of NITEL to facilitate the provision of Internet services.

4.13 TEST OF HYPOTHESES

In the course of this study, four hypotheses were formulated to test the validity of the study. The data used for the testing of the hypotheses was derived from the questionnaire distributed to the respondents of the NNPC and its subsidiaries.

4.13.1 Hypothesis I

1. Ho: The core capabilities in NNPC and its subsidiaries on production, investment and strategic marketing do not encourage the adoption of Information and Communication Technologies.

Ha: The core capabilities in NNPC and its subsidiaries on production, investment and strategic marketing encourage the adoption of Information and Communication Technologies.

Department	Top Management	Middle Management	Supervisors	Junior Cadre	Total
Finance/Account	13	18	19	23	73
Production	16	22	23	19	80
Marketing	18	25	26	33	102
Administration	21	20	28	62	131
Total	68	85	96	137	386

Source: Survey Data

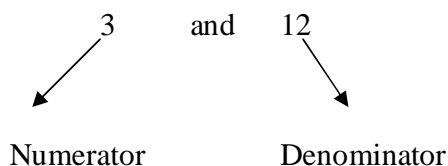
(See appendix 1-3 for detailed calculation)

ANOVA TABLE

Variation	Degree of Freedom	Sum of Square	Mean Square	F-ratio
Explaining by treatment (between columns)	$C - 1$ $4 - 1 = 3$	SST = 649.18	MST = 216.37	F-ratio $= \frac{MST}{MSE}$
Errors or unexplained (within columns)	$(r - 1)c$ $(4 - 1)4 = 12$	SSE = 1237.74	MSE = 103.145	$= \frac{216.30}{103.145}$ 2.097

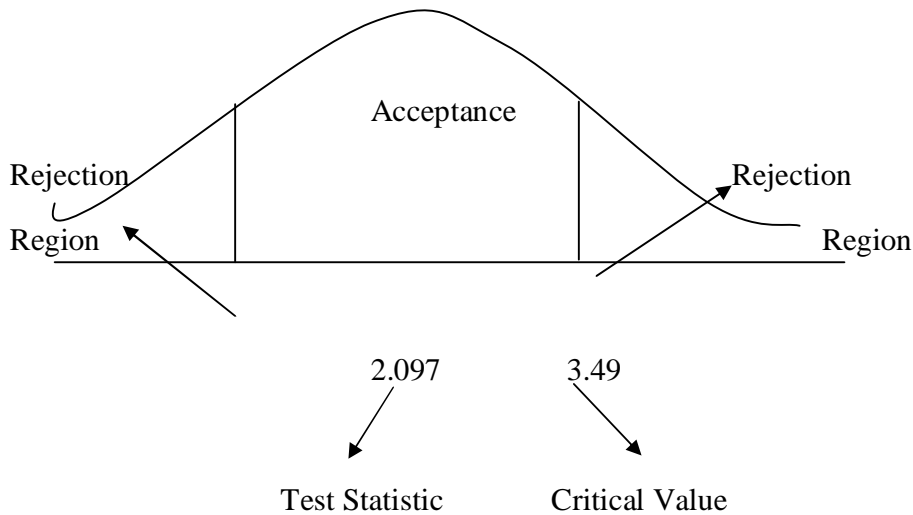
Df = $(c - 1)$ and $(r - 1)c$

$(4 - 1)$ and $(4 - 1)4$



Given that $\alpha = 0.05$

$F_{0.05} = (3, 12) = 3.49$ (critical value)



Decision

Since $3.49 \geq 2.097$, we accept the Null hypothesis which states that the core capabilities in NNPC and its subsidiaries on production, investment and strategic marketing do not encourage the adoption of Information and Communication Technologies.

4.13.2 Hypothesis 2

2. Ho: Technical change and government economic policy do not impact heavily on the performance of the NNPC and its subsidiaries.

Ha: Technical change and government economic policy impact heavily on the performance of the NNPC and its subsidiaries.

Refineries	Technological learning	Technical change	Total
Port Harcourt Refinery	47	55	102
Warri Refinery	42	40	82
Kaduna Refinery	37	27	64
Total	126	122	248

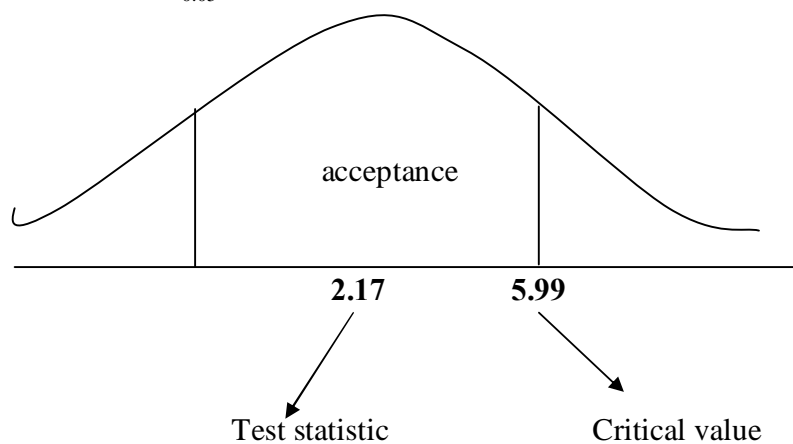
Source: survey data

Refineries	Technological learning	Technical change	Total
Port Harcourt Refinery	47/51.82	55/50.18	102
Warri Refinery	42/41.66	40/40.34	82
Kaduna Refinery	37/32.52	27/31.48	64
Total	126	122	248

Source: Survey data

fa	fe	fa-fe	(fa-fe) ²	$\frac{(fa - fe)^2}{fe}$
47	51.82	-4.82	23.23	0.448
55	50.18	4.82	23.23	0.463
42	41.66	0.34	0.1156	0.003
40	40.34	-0.34	0.1156	0.0028
37	32.52	4.48	20.07	0.617
27	31.48	-4.48	20.07	0.6375
				$X^2 = 2.17$

$df = (r-1) \text{ and } (c-1)$
 $(3-1)(2-1)$
 $(2)(1)$
 $df = 2$
 $X^2_{0.05} = 5.99$



Decision:

Since $5.99 \geq 2.17$, we accept the Null hypothesis that states Technical change and government economic policy do not impact heavily on the performance of the NNPC and its subsidiaries.

4.13.3 Hypothesis 3

3. Ho: Strong and Dynamic technological adoption do not facilitate the achievement of economies of scale in the operations of NNPC and its Subsidiaries.

H_A: Strong and Dynamic technological adoption facilitates the achievement of economies of scale in the operations of NNPC and its Subsidiaries.

Oil industry	To a very large extent	To a large extent	Neutral	To a small extent	To a very small extent	Total
NNPC	41	37	13	28	19	138
Port Harcourt	25	31	11	21	14	102
Warri Refinery	26	20	6	18	12	82
Kaduna Refinery	21	18	4	12	9	64
Total	113	106	34	79	54	386

Source: survey data

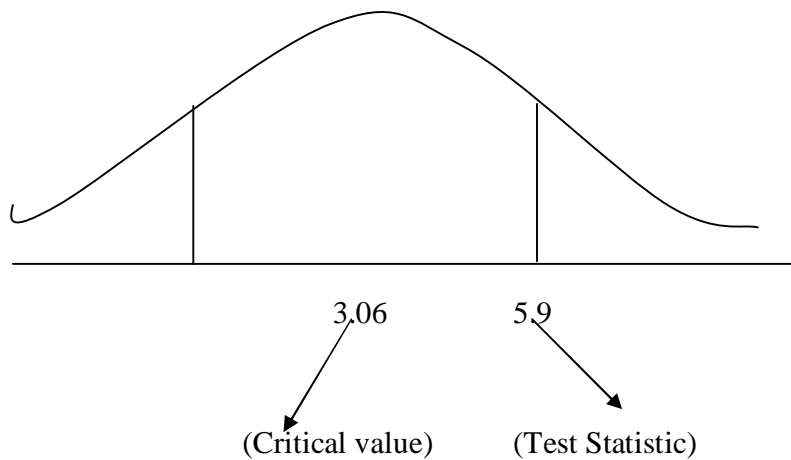
ANOVA TABLE

Variation	Degree of freedom	Sum of square	Mean square	F-ratio
Explained by treatment (between columns)	C-1 5-1 =4	SST= 1129.69	MST=216.37	F-ratio = $\frac{MST}{MSE}$
Error or unexplained (within columns)	(R-1)C 15	SSE = 714.48	MSE=103.145	= $\frac{282.42}{47.63}$
Total	RC = 19	Total SS = 1844.17		= 5.9

$$\begin{aligned} \text{Df} &= (c-1) \text{ and } (r-1)c \\ &= (5-1) \text{ and } (4-1)5 \\ &= 4 \quad \text{and} \quad 15 \\ &\swarrow \quad \quad \quad \searrow \\ &\text{Numerator} \quad \quad \quad \text{Denominator} \end{aligned}$$

Given that $\alpha = 0.05$

$$f_{0.05} = (4, 15) = 3.06 \text{ (critical value)}$$



Decision:

Since $3.06 \leq 5.9$, we reject the Null hypothesis which states that Strong and Dynamic technological adoption do not facilitate the achievement of economies of scale in the operations of NNPC and its Subsidiaries.

4.13.4 Hypothesis 4

4. Ho: Telecommunications services in the NNPC and its subsidiaries are not very effective as growth and productivity instruments.

Ha: Telecommunications services in the NNPC and its subsidiaries are effective as growth and productivity instruments.

This test of hypothesis investigated the impact of telecommunications services in the NNPC and its subsidiaries uses of ICTs. Multivariate probit analysis was used to estimate

how much the quality of telecommunication infrastructure affected e-mail, web and computers use in the NNPC and its subsidiaries. The following model was adopted.

$$\text{Performance} = a + \text{BICT}_{jk} + \text{YX}_{jk} + \text{V}_j + \text{E}_t + \text{E}_{ijk}$$

Where performance jk = Performance of NNPC and its subsidiaries

$$Q = \text{constant}$$

Ict_{ijk} = An indicator reflecting enterprises use of ICT and based on three ICT indicators, namely e-mail, web and employees that uses computer.

A_j , U_j , E_{jk} and W_t = Dummy variables.

The performance measures used for the analysis included the following:

- Sales growth
- Employment growth
- Investment rate
- Reinvestment rate
- Profitability
- Technical efficiency.

The dummy variables introduced indicated the NNPC and its subsidiaries communicate with clients and supplies using neither e-mail or web. The indicators were used to test the robustness of results. The indicators were typical available at the NNPC and its subsidiaries and they captured different aspects of ICTs use.

In addition to the variables, the model also included X_{jjk} , a vector of NNPC and its subsidiaries level characteristics. These included enterprise size percent % sales. The model included series of dummy variables for control purposes (Y_t , U_j , E_{jk} and W_t).

Table 4:18 below represent the regression results on the effect of computer use on different measures of performance (NNPC and its Subsidiaries)

Indicator	Sales growth(%)	Employment (%)	Investment rate(%)	Re-nvestment rate (%)	Profit rate (%)	Technical efficiency (%)
Observation	81.16	87.10	3.6	2.09	47.14	43.31
Computer use	0.0001	-0.0001	0.0003	0.1465 ^{xxx}	0.0007 ^x	0.0004 ^{xxx}
Percentage of workers who use computers	(0.64)	(0.92)	(1.53)	(4.41)	(1.78)	(7.69)
Workers	0.0144 ^{xxx}	0.0249 ^{xxx}	0.0350 ^{xxx}	0.1367 ^{xxx}	0.0112 ^x	0.005
R ²	0.04	0.12	-	-	0.05	0.04

Note: The numbers in parentheses are t-statistics

Xxx, x denote statistical significance at 1 percent and 10 percent levels respectively

Source: survey result.

Table 4:19 below represent the effect of web use on different measures of performance (NNPC and its subsidiaries).

Indicator	Sales growth (%)	Employment (%)	Investment rate (%)	Re investment rate (%)	Profit rate (%)	Technical efficiency (%)
Observation	89.26	12.7	37.10	48.25	54.22	49.00
Use web to communicate with clients and supplies	0.0203 ^{xx}	0.0178 ^{xxx}	0.0210	3.6031 ^{xxx}	0.093 ^{x x}	0.0041
Workers	0.0135 ^{xxx}	0.0204 ^{xxx}	0.0319 ^{xxx}	0.710 ^{xxx}	0.0013	0.0032
Export	0.000	-0.003 ^{xxx}	-0.0004 ^{xx}	-0.01675	0.001	0.0000
Percentage of sales	(0.26)	(0.65)	(1.52)	(-0.67)	(0.48)	(1.40)
R ²	0.05	0.11	-	-	0.05	0.02

Note: The numbers in parentheses are t-statistics

Xxx, xx denote statistical significance at the 1 percent and 5 percent levels respectively

Source: survey result.

Table 4:19 above represent the effects of web use on different measures of enterprise performance (NNPC and its subsidiaries).

From the tables above, (4.18 and 4.19) the negative and statistically significant coefficients for the variables suggested when the quality of telecommunications service was poor, the NNPC and its subsidiaries were less likely to e-mail or the web to

communicate with clients and less likely to use computers. The effect of the quality of telecommunications service appears relatively small. The results for e-mail and web use were robust for the different measures of the quality of telecommunications services. The results for the percentage of workers using computers were not robust. This not surprising, computers use alone did not rely directly on telecommunications service. The results suggested that ICTs were wide spread in NNPC and its subsidiaries and that ICTs playing an important role in allowing the NNPC and its subsidiaries to grow faster and become more productive.

This analysis suggested that creating an appropriate environment to exploit ICTs are important. ICTs applications offer digital opportunities to NNPC and its subsidiaries. The national assumption is that all firms should invest in these technologies and adopt them for doing business.

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CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 DISCUSSION

Over the past years, Nigerian National Petroleum Corporation (NNPC) and its subsidiaries have devoted considerable resources to developing its information strategy and have conducted research to determine the appropriate framework for building an information organization. This information process involves investing significantly in infrastructure that facilitates the use of ICTs by government, industry and the general public (IFC, 2005). Qiang (2003) emphasizes that ICTs assist countries/organizations achieve goals in several ways:

- First it spurs innovation: ICTs including the internet allows information and knowledge to be shared more easily, facilitating new forms of economic and social interaction.
- Second, ICTs supports the efficient use of economic resources. In the case, ICTs also supports sustainable economic growth and the development of post industrial service economies.
- Third, ICTs increases productivity and thus international competitiveness. Technological innovation is a central determinant of competitiveness in the global economy and the country's information strategy can help develop an enabling environment for it.

As we have seen in this study, ICTs are general purposes technology that establishes a new technological paradigm and results in a fundamental restructuring of the economy and of production in particular. General purpose technologies (ICTs) represent an innovation and produce discontinuity in the path of technological development.

Information and communication Technologies are widely used to gather and transmit information, design complex new products and coordinate and conduct research in different areas. This made product and process innovation much easier, resulting in

faster growth in the number of intellectual property rights and patents issued than at any other period in history, as well as a general acceleration of economic processes "Yong 2005:12).

Around the world, ICTs have changed the structure of manufacturing and service industries and of production chains. As general purpose technologies, ICTs have become a source of economic value by processing, organizing, storing and transmitting information. The social effect of ICTs is comparable to that of printing, both of which enable people to gain knowledge.

Perkinson (2005:36-38) stresses three levels of information and communication technologies (ICTs) which include:

- A general public able to use ICTs applications at work and home. Information managers who lead ICTs development in government and business.
- ICTs professionals experienced in network design, soft development and research and development.

As a way forward, as information accelerates, NNPC and its subsidiaries should need more ICTs experts as well as workers with adequate ICTs skills. The various stakeholders, the government, enterprises, research institutions and individuals should work together to build up the human resources needed to maximize the economic and social benefits from ICTs development. It is important to create a shared vision among and within stakeholders to co-ordinate plans and projects for educational information. The government should strengthen the links between universities and firms by providing institutional foundations such as the establishment of intermediary institutions as done in developed countries such as Germany. The government should enforce intellectual property rights more strictly to support incentives for investors. It is important to note that the ICTs applications make the flow of information more efficient and systematic, supporting the development of an information society.

5:2 ICTS INITIATIVES IN NIGERIA

This period has witnessed amazing development and breakthrough in Information Technology, computer communications, software Technology, Internet and Worldwide Web (www) technology among others. These technologies have impacted all aspects of our life and have made the world a global village. The progress in these technologies have continued at a rapid pace and made economical, political, social, cultural, educational, psychological impacts among others.

The Internet and www have moved computing, communications and IT applications in general to the main stream. The technologies are used on a daily basis in applications such as e-commerce, e-business, e-government etc. The release of the worldwide web (www) in the early 1990s has moved the Internet and telecommunications to the mainstream. The web served as a platform for enabling and deploying hundreds of applications, including online stock trading and banking and information retrieval services. The study emphasizes that training of people especially skilled people on ICTs technologies are very essential. In Nigeria, several attempts have been made for the development of the Information and communication Technology sector without much success. The lack of success was largely due to lack of trust and faith in the various policies and programmes initiated by the previous administration. For effective national development, Information and communication Technologies are an important ingredient for development and it requires the government initiative to fully harness its potentials. Policies that should encourage result-oriented development should be put in place honestly and faithfully.

Information and communication Technologies (ICTs) initiatives in Nigeria started with the establishment of National Broadcasting commission (NBC) and the Nigeria communication commission (NCC).

Both commissions were formed in 1992, while the NBC was able to achieve some success by licensing private operators, the NCC could not function as the NBC until 1997, when few wireless operators were licensed to provide telephone services mainly in Lagos. The NCC could not function as a commission properly until the Obasanjo administration came into power in 1999 and was properly constituted as a commission in April 2000 (Ndukwe 2003:27-29). The success of these private radio and television stations helped in setting the pace for the deregulation in other sectors of the economy. It should be noted that if the sector had been left in the hands of government alone, the society would have been left on the wrong side of an ever-widening divide, not just a digital divide of access to new technology, but a divide of information of knowledge and of governance. A plus to the Obasanjo administration was the initiative for the National policy on Information Technology (Adeboye, 2004:23-24). The major focus of the policy was the development of local capacity for the production of software for both the private and public sector of the economy. Breakthrough in ICTs through telephone was achieved in January 2001 when the sector was totally liberalized with the licensing of MTN and ECONET, which injected over 1,100,00 lines into the nation within a space of one year (Adeboye, 2004:23-24). The Global system of Mobile communication (GSM) spread in a highly competitive manner from state to state and city to city. This has remained the best dividend of democracy to Nigerians since the advent of the third Republic. The provision of SMS with the GSM option has greatly enhanced the benefit of the system while improving information exchanges.

A tremendous improvement on ICTs in Nigeria is a clear sign of progress in the right direction. The effective deployment of the technology has been associated with industrial competitiveness, productivity efficiency, economic development, business growth, business flexibility, quality and the quality and the maintenance of high wage jobs (World Bank, 1998). Technology diffusion involves the dissemination of technical

information and know-how and the subsequent adoption of new technologies and techniques by users (Tassey, 1992:51-53).

Amidon (1997:32-34) stresses that technology diffusion could be contrasted with technological innovation, which involves the development of new knowledge, products or process. In many cases, diffused technologies are neither new nor necessarily advanced and may be acquired from a variety of sources, including private vendors, customers, consultants and peer firms.

Hippel (1987: 91-94) points that technology can be diffuse through the internal catch-up efforts of firms, the transfer and mobility of skilled labour and the activities of professional societies.

5.3 NEED FOR CAPACITY BUILDING IN NNPC AND ITS SUBSIDIARIES

The issue of capacity building is critical and the scale of need is enormous. The needs for capacity building are always changing. In its broadest interpretation, capacity building encompasses Human Resource Development (HRD) as an essential part of development. It is based on the concept that education and training lie at the heart of development efforts and that without HRD, most development interventions might be ineffective. It focuses on a series of action directed at helping participants in the development process to increase their knowledge, skills, and understandings and to develop the attitudes needed to bring about desired developmental change.

Specifically, capacity building encompasses the country's human scientific, technological organizational, institutional and resource capabilities (Amidon, 1997:18-19). A fundamental goal of capacity building is to enhance the ability to evaluate and address the crucial questions related to policy choices and modes of implementation among development options, based on an understanding of environmental potentials and limits perceived by the people concerned.

United Nation Development Programme (2005) recognizes that capacity building is a long-term, continuing process in which all stakeholders should participate. Capacity building could therefore be viewed as activities which an organization, enterprise or even a nation needs to undertake to provide for itself on a continuous basis, a regular supply of skill manpower to meet its present and future needs. As Hippel (1987:42-44) points out, the prosperity of any enterprise or even a nation depends to a large extent on the competitiveness of its workforce.

As a resource and like some other factors of production, human capital has a life span, not in terms of life expectancy at birth, but life span measured by economically active period. In the Nigerian context, economically active period is usually between 15 and 65 years or at most 70 years. The report of the vision 2010 committee expects Nigeria by the year 2010:

To be a united, industrious, caring and God fearing democratic society, committed to making the basic needs of life affordable for everyone and creating Africa's leading economy.

The Report acknowledges that the achievement of this vision calls for a paradigm shift in the mind-set of all Nigerians to imbibe new core values, norms and standards that align with the globalization and liberalization. (Committee Report, Vision 2010: 30-36).

The maiden edition of UNDP Human Development Report (2004:89-94) states that: Human Development is a process of enlarging people's choice.

The key element of the Human Development Index (HDI) includes life expectancy, education and basic purchasing power. These elements are used in proxies in measuring the extent to which people benefit from the development process. With this perspective, no growth is considered worth its purpose if it is not translated in human development terms. In other words, development must be seen as improvements in people's standard of living.

By virtue of Nigeria's size, natural resources and economic importance as a major exporter of crude oil, the situation on ground does not present any better picture. Report from the Federal office of statistics (2005) indicated that 58.6 percent of Nigerians are living below the poverty line in 2004. in spite of the various attempts to build human capital over the years, many development problems seemed to have stultified the initial attempts.

The training and development of human capital cannot be over emphasized. Sachas (2000:25-28) indicates that training and development of staff should be aimed at helping people develop their capabilities so that the organization can meet most, if not all its future requirements. The issue of utilization of available human resource should be regarded as very important if the whole objective of capacity building is to be achieved. There is the need for optimum utilization of human capital in the NNPC and its subsidiaries. In effect, every effort should be made to ensure that a square peg is put in a square hole for the benefits of stakeholders, the organizations, the staff and the economy as a whole. To achieve this, there is the need to improve the economic base to accommodate more human resource currently in the labour market. The government should ensure that in spite of the policy on quota system, only qualified persons are given political appointments.

We need to bear in mind that the whole essence of capacity building and utilization are to improve the standard of living of the people. There are needs for the pursuit of capacity building that could equip people with the skills and competencies that are required both for employment and job creation as well as entrepreneurial development. It therefore follows that individuals, enterprises, governments and society need to invest in human capital development and utilization. Government too has the responsibility to create a conducive environment for business to thrive and for industry to play the expected driver's role in the emerging economic scenario.

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CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 SUMMARY OF MAJOR FINDINGS

The study provides empirical evidence that the adoption of ICTs in the NNPC and its Subsidiaries is beneficial. It was found that the staff of the NNPC and its Subsidiaries needed training in information technology so as to cope with the general information usage to brace-up with the high demand in the information Technology. The study revealed that all levels of staff were involved in the training programmes and that the Human Resource Departments of the refineries were in charge of organizing training programmes in information technology.

However, respondents complained that training calendars were not strictly adhere to and as a result made the staff to attend training courses at any time unplanned.

The study also identified that the history of oil exploration in Nigeria might not have been possible if not for the efforts of the early foreign investors who in the face of many risks took the step to explore the nation for oil. Apart from the fact that the nation did not have the technology required for the operation, the capital needed for such investment was enormous for a developing country like Nigeria to afford at the time. The decision to allow foreign investors to take the lead was a welcome idea.

This study found that technology acquisition mechanisms could best assist NNPC and its subsidiaries to achieve sustained development when they embody the following factors: (Anty, 2007:12-14).

- All key stakeholders actively and genuinely participate in all aspects of the technology acquisition process.
- Information Technology capability in terms of human resources development, infrastructural and institutional developments should be strengthened.

- Encourage the growth of local IT companies through demand and supply-side intervention.
- Monitoring and evaluation mechanisms should be developed and implemented effectively.
- Inter and intra organizational linkages are necessary to take advantage of new economic opportunities.
- Provide the necessary telecommunications infrastructure to develop, use and diffuse.
- Encourage and assist IT professionals in order to maintain professional standards and provide for career development.

After studying a wide range of refineries operations, we found that Information and Communication Technologies have changed the rules of competition, structure and are becoming an important lever that NNPC and its subsidiaries could use to create competitive advantage. There is great optimism over the potential for Information and communication Technologies (ICTs) to promote economic development and alleviate poverty.

This study identified that if the NNPC and its subsidiaries should develop the needed capacity to face the technological challenges of the 21st century, they should establish institutional structures, articulate policies and monitors their implementation. Many laudable policies, programmes and institutions in the past have been hampered or rendered counter-productive by gross incompetence, lack of co-ordination, bureaucratic phevlegmatism, politics and/or corruption. An effective institutional partnership through networking should be established so that ideas, information and personnel could be exchanged among collaborating institutions. In addition, the government needs to review its legislation from time to time through a participatory mechanism to meet the needs of changing technological requirements. Capacity building policies and programmes should be grounded in an appraisal of the environment.

6.2 CONCLUSION

The study investigated the diffusion and adoption of information and communication technologies in the management of NNPC and its Subsidiaries. Based on the findings of the study, it is concluded that NNPC and its Subsidiaries made a good start in the adoption of information and communication technologies (ICTs). The study identified that the ICTs development in Nigeria passed through three distinct phases, first the early phase (1963 ó 1975), second the period of rapid growth (1977 ó 1982), third period of relative stagnation (1982 ó 1986). Currently, there are upsurge in the acquisition and use of computers. The study identified that the application of the new technologies in the refineries production go a long way in minimizing the potential for unconfined flaring of gas in the numerous oil fields in Nigeria. Curbing flared gas could offer oil field operators significant safety. It might substantially reduce atmospheric GREEN HOUSE emission, thereby, securing environmental stability in the oil region. Such reduction in emission could possibly attract companies in advanced countries seeking carbon reduction credit under the Kyoto protocol programmes of emission trading. This might be an added source of revenue to the country. The study concluded the need for adequate training and development in all aspects of information technology for all staff.

It is for this reason that the management of NNPC and its Subsidiaries should place highest development priority on building human capital. Dependence on the natural resources (Oil and Gas) only might not guarantee the future existence of Nigeria as a nation, only the human capital resources can sustain it for generations yet unborn.

The study advocates for an urgent need to re-define, update and re-focus our national development strategies to critically address ICTs interventions in four critical areas namely;

- ✓ Infrastructural development
- ✓ Rural Community development

- ✓ Public ó Private Sector Partnership
- ✓ Good governance and legislation

We observed that over the years, ICTs related issues have not been accorded attention they deserve as the catalyst of change for national development. The simple truth today is that no nation can effectively succeed in solving the 21st century development challenges unless the nation's vision, aspiration, mission and strategies are fundamentally anchored in the realm of knowledge creation and strategically driven by science and technology with information and communication technologies (ICTs) being key component of the nation's success.

6.3 RECOMMENDATIONS

On the basis of the findings of this study, the following recommendations are made to facilitate the full application of ICTs in NNPC and its subsidiaries:

1. Appropriate laws should be enacted to protect Nigeria's oil industry from foreign competitors especially as local markets are opened-up to outside investment.
2. In order to protect local software entrepreneurs and foreign investors, the government should formulate policy to discourage software piracy and enact laws to punish offenders.
3. The refineries should increase the duration of its training session and should purchase more computers so that all staff can have access to computers.
4. There is need for the government to allocate special funds to its oil agencies annually or quarterly for the purchase of training facilities.
5. Obsolete equipment for training should be scrapped; proper maintenance of equipment and available technicians should be made possible.
6. Wireless base stations to be installed and manage carefully in order to preclude congestion.
7. A national maintenance policy to be drafted and localized in every sector of the economy.

8. Nigerian software entrepreneurs should be encouraged and supported with low interest loans and other incentives.
9. It is essential to install communications and information infrastructures capable of supporting the creation and sharing of information and knowledge.
10. It is important to establish legislation for e-business as well as national digital certification agency.
11. Establishment of research parks for ICTs programmes.

Information and communication Technologies as identified in this study are powerful means of promoting economic growth and social development. It is vital that the country and in particular, the NNPC and its subsidiaries to respond to this new paradigm, otherwise, they might not be in a position to participate effectively in the global economy.

6:4 FUTURE RESEARCH DIRECTIONS

The scope of this study was limited to the NNPC and its subsidiaries. The study opened several discussions for future investigations in the industry. Further research is required to expand and refine the theoretical basis of social and cultural levels of the adoption and diffusion of information and communication technologies in the NNPC and its subsidiaries and to extend the range of improvement strategies. Extensive in-depth case studies are also required to better understand the effects of social and cultural levels of information and communication technologies. Such studies should be conducted using research approaches that challenge the positivist tradition that underpin much of information systems, reflect the subjectivist ideologies and epistemologies that seek understanding in a social and cultural context framed by management influence. Researchers are encouraged to test empirically the research work as embodied in this study across NNPC and its subsidiaries, conduct an in-depth interviews to ascertain the findings and provide anecdotal evidence. The assessed significant linkages would be useful in providing better understanding of the results.

6.5 CONTRIBUTION TO KNOWLEDGE

The following contributions to knowledge are shown below:

- NNPC and its subsidiaries have major role to play in transforming Nigeria into a digital economy and should make strategic investment in technology in order to improve its productivity.
- ICTs have the potential to create earnings opportunities/jobs, improve delivery, and facilitate knowledge creation to NNPC and its subsidiaries.
- The tertiary institutions should be properly funded with focus on software engineering and that technology foundation similar to America's National Science Foundation should be created to fund ICTs projects in Nigeria's institutions.
- Technological capacity building and utilization remained part of the strategies for tackling the questions of technologically backwardness.
- All successful economies of the world are knowledge based and technologically driven.
- There exist paradigm shift in global development and NNPC and its subsidiaries cannot pretend not to be affected by the emerging impact.
- Human acquisition of technological knowledge, skills and abilities should be achieved through education and learning.
- Fixing the country educational systems and generating phalanxes of skilled high-tech workers would set the country on the road to rebirth.
- There is the need to partnership ICTs industry, academia and civic organizations to highlight the need for successful adoption and diffusion of ICTs to other organizations.
- The means of improving the quality is by investing in staff development and retraining in information and communication technologies applications..

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Appendix I

Department	Top Management	Middle Management	Supervisor	Junior Grade	Total
Finance/Accts.	13	18	19	23	73
Production	16	22	23	19	80
Marketing	18	25	26	33	103
Administration	21	20	28	62	131
Total	68	85	96	137	136
	$X_1 = 17$	$X_2 = 21.3$	$X_3 = 24$	$X_4 = 34.3$	

Source: Survey Data

$$\text{Grand mean } (\bar{x}) = \frac{\sum_i \sum_j X_{ij}}{rc} = \frac{\text{Grand Total}}{rc}$$

$$\text{Grand Total} = 68 + 85 + 96 + 137 = 386$$

$$\text{Grand mean } (\bar{x}) = \frac{386}{16} = 24.125$$

$$\text{Sum, of squares (SST)} = r \sum (x_i - \bar{x})^2$$

$$\text{SST} = 4[(17 - 24.125)^2 + (21.3 - 24.125)^2 + (24 - 24.125)^2 + (34.3 - 24.125)^2]$$

$$= 4[50.77 + 7.98 + 0.0156 + 3.53]$$

$$= 4[162.296]$$

$$\text{SST} = 649.18$$

$$\text{Error Sum of Squares (SS)} = \sum_i \sum_j (X_{ij} - X_i)$$

$(X_i \text{ ó } X_i)^2$	$(X_{12} \text{ ó } X_2)^2$	$(X_{13} \text{ ó } X_3)^2$	$(X_{14} \text{ ó } X_4)^2$
$(13-17)^2 = 16$	$(18-21.3)^2 = 10.89$	$(19-24)^2 = 25$	$(23-34.3)^2 = 127.69$
$(16-17)^2 = 1$	$(22-21.3)^2 = 0.49$	$(23-24)^2 = 1$	$(19-34.3)^2 = 234.1$
$(18-17)^2 = 1$	$(25-21.3)^2 = 13.69$	$(26-24)^2 = 1$	$(33-34.3)^2 = 1.69$
$(21-17)^2 = 16$	$(20-21.3)^2 = 1.69$	$(28-24)^2 = 6$	$(62-34.3)^2 = 767.5$
34	26.76	46	1130.98

$$SSE = 34 + 26.76 + 1130.98$$

$$= 1237.74$$

$$\text{Total SS} = \sum \sum (X_{ij} - \bar{x})^2$$

$$\text{Total SS} = \text{SST} + \text{SSE}$$

$$= 649.18 + 1237.74$$

$$= 1886.92$$

$$\text{Treatment mean square (MST)} = \frac{\text{SST}}{C - 1}$$

$$\text{MST} = \frac{649.18}{4-1} = \frac{649.18}{3} = 216.39$$

$$\text{Error mean square (MSE)} = \frac{\text{SSE}}{(r-1)c}$$

$$= \frac{1237.74}{(4-1)4} = \frac{1237.74}{12}$$

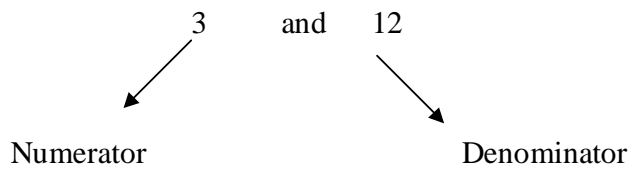
$$\text{MSE} = 103.145$$

$$\text{F-ratio} = \frac{\text{MST}}{\text{MSE}} = \frac{216.39}{103.145}$$

$$\text{F-ratio} = \underline{2.097}$$

$$\text{df} = (c-1) \text{ and } (r \text{ ó } 1) c$$

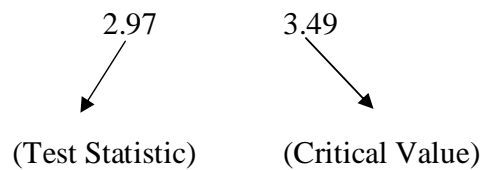
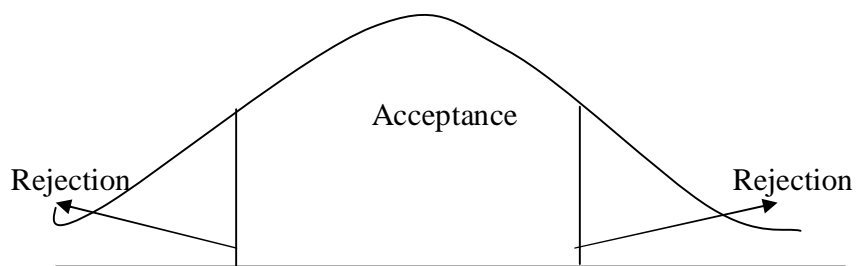
$$(4 \text{ ó } 1) \text{ and } (4 \text{ ó } 1) 4$$



Given that $\alpha = 0.05$

$f_{\alpha} = 0.05$

$f_{0.05} = (3,12) = 3.49$ (critical value)



APPENDIX II

Refineries	Technological Learning	Technical change	Total
Port Harcourt Refinery	47	55	102
Warri Refinery	42	40	82
Kaduna Refinery	37	27	64
Total	126	122	248

Source: Survey data

Refineries	Technological Learning	Technical change	Total
Port Harcourt Refinery	47/51.82	55/50.18	102
Warri Refinery	42/41.66	40/40.34	82
Kaduna Refinery	37/32.52	27/31.48	64
Total	126	122	248

Fa	Fe	Fa-fe	(fa ó fe) ²	$\frac{(fa \text{ ó } fe)^2}{fe}$
47	51.82	4.82	23.23	0.448
55	50.18	4.82	23.23	0.463
42	41.66	0.34	0.1156	0.003
40	40.34	0.34	0.1156	0.0028
37	32.52	4.48	20.07	0.617
27	31.48	4.48	20.07	0.6375

$$\underline{X^2 = 2.17}$$

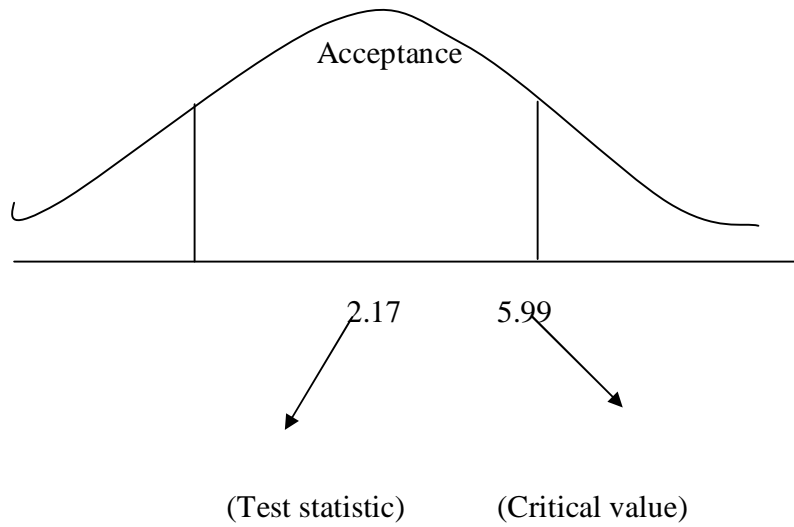
$$Df = (r \text{ ó } 1) \text{ and } (c-1)$$

$$(3 \text{ ó } 1)(2-1)$$

$$(2)(1)$$

$$df = 2$$

$$X^2_{0.05} = 5.99$$



APPENDIX III

Oil Industry	To a very large extent	To a large extent	Neutral	To a small extent	Small extent	Total
NNPC	41	37	13	28	19	138
Port Harcourt Refinery	25	31	11	21	14	102
Warri Refinery	26	20	6	18	12	82
Kaduna Refinery	21	18	4	12	9	64
Total	113	106	34	79	54	386
	X ₁ =28.25	X ₂ =26.5	X ₃ =8.5	X ₄ =19.75	X ₅ =13.5	

Source: Survey Data

Grand Total = 113 + 106 + 34 + 179 + 54 = 386

Grand mean (\bar{x}) = $\frac{\sum_i \sum_j X_{ij}}{rc}$

$$\bar{X} = \frac{\text{Grand Total}}{rc} = \frac{386}{(4)(5)}$$

$$\bar{X} = \underline{19.3}$$

Treatment Sum, of squares (SST) = $r\sum(x_i - \bar{x})^2$

$$\text{SST} = 4[(28.25 - 19.3)^2 + (26.5 - 19.3)^2 + (8.5 - 19.3)^2 + (19.75 - 19.3)^2 + (13.5 - 19.3)^2]$$

$$\text{SST} = 4[80.10 + 51.84 + 166.64 + 0.2025 + 33.64]$$

$$= 4[282.42]$$

$$\text{SST} = 1129.69$$

Error Sum of Squares (SSE) = $\sum_i \sum_j (X_{ij} - \bar{X}_j)^2$

$(X_i - \bar{X}_i)^2$	$(X_{12} - \bar{X}_2)^2$	$(X_{13} - \bar{X}_3)^2$	$(X_{14} - \bar{X}_4)^2$	$(X_{14} - \bar{X}_4)^2$
$(41 - 28.25)^2 = 162.56$	$(37 - 26.3)^2 = 110.25$	$(13 - 8.5)^2 = 20.25$	$(28 - 19.75)^2 = 68.06$	$(19 - 13.5)^2 = 30.25$
$(25 - 28.25)^2 = 10.56$	$(31 - 26.5)^2 = 20.25$	$(11 - 8.5)^2 = 6.25$	$(21 - 19.75)^2 = 1.56$	$(14 - 13.5)^2 = 0.25$
$(26 - 28.25)^2 = 5.06$	$(20 - 26.5)^2 = 42.25$	$(6 - 8.5)^2 = 6.25$	$(33 - 34.3)^2 = 1.69$	$(12 - 13.5)^2 = 2.25$
$(21 - 28.25)^2 = 52.56$	$(18 - 26.5)^2 = 72.25$	$(4 - 8.5)^2 = 20.25$	$(12 - 19.75)^2 = 60.06$	
Total = 230.74	Total = 245	Total = 53	Total = 132.74	Total = 53

Source: Survey Data

$$\text{SSE} = 230.74 + 245 + 53 + 132.74 + 53$$

$$= 714.48$$

Total Sum of Square (Total SS) = $\sum \sum (X_{ij} - \bar{x})^2$

$$\text{Total SS} = \text{SST} + \text{SSE}$$

$$= 1129.69 + 714.48$$

Total SS= 1844.17

$$\text{Treatment mean square (MST)} = \frac{SST}{C - 1}$$

$$\text{MST} = \frac{1129.69}{4}$$

$$\text{MST} = \underline{\underline{283.42}}$$

$$\text{Error mean square (MSE)} = \frac{SSE}{(r-1)c}$$

$$= \frac{714.48}{15}$$

$$\text{MSE} = 47.63$$

$$F \text{ ó ratio} = \frac{\text{MST}}{\text{MSE}} = \frac{283.42}{47.63}$$

$$F \text{ ó ratio} = \underline{5.9}$$

$$\text{df} = (c-1) \text{ and } (r-1)c$$

$$(45-1) \text{ and } (4 \text{ ó } 1) 5$$

$$4 \text{ and } 15$$

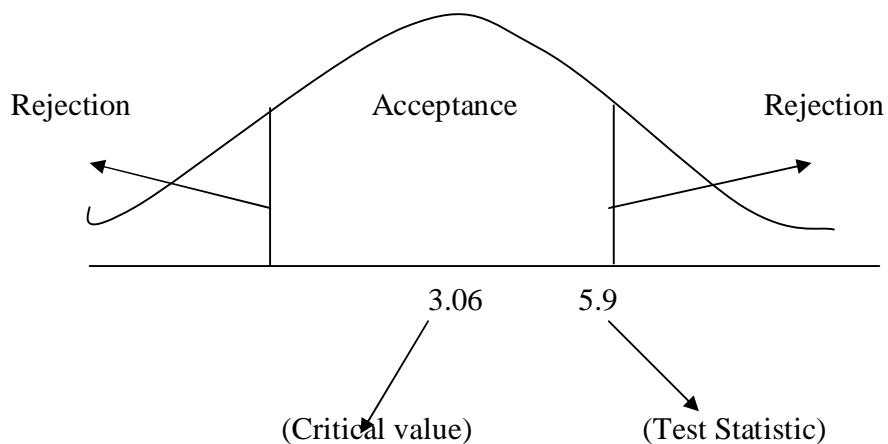
Numerator

Denominator

Given that $\alpha = 0.05$

$$f_{\alpha} = 0.05$$

$$f_{0.05} = (4,15) = 3.06 \text{ (critical value)}$$



APPENDIX 4: HISTORY OF NIGERIAN OIL INDUSTRY

- 1908: Nigerian Bitumen Co. and British Colonial Petroleum Commenced Operations around Okitipupa.
- 1938: Shell DøArchy granted exploration licence to prospect for oil through Nigeria.
- 1955: Mobil Oil Corporation started operating in Nigeria.
- 1956: First successful well drilled at Olobiri by Shell DøArcy
- 1956: Changed name to shell-BP Petroleum Development Company of Nigeria Limited.
- 1958: First Shipment of Oil from Nigeria.
- 1961: Shellø Bonny Terminal was commissioned.
- 1961: Texaco Oversees started operations in Nigeria.
- 1961: Golf Oil Company started Operation in Nigeria.
- 1962 ELF started operation in Nigeria as Safrap.
- 1962: Nigeria Agip Oil Company started operations in Nigeria
- 1963: ELF discovered Obagi field and Ubeta Gas field
- 1963: Gulf oil discovered their first oil at Okan-1
- 1965: Agip found its first oil at Ebocha
- 1965: Gulfø first production
- 1965: Phillips Oil Company started operations in Bendel State.
- 1966: ELF started production in Rivers State with 12,000 b/d
- 1967: Phillips First Oil discovery at Gilli-Gilli-1
- 1968: Mobil producing Nigeria Limited was formed.
- 1968: Gulfø terminal at Escravos was commissioned.
- 1970 Mobil started production from 4 wells at Idoho field.
- 1970: Agip started production

- 1970: Government started its Department of Petroleum Resources inspection (DPR)
- 1971: Shell's Forcados Terminal Commissioned.
- 1971: Mobil's terminal at Qua Iboe Commissioned
- 1973: First participation Agreement, federal government acquires 35% shares in the oil companies.
- 1973: Ashland started PSC with then NNOC (NNPC)
- 1973: Pan Ocean Corporation drilled its first discovery well at Ogharefe-1
- 1973: Second participation Agreement, Federal Government Increase equity to 55%.
- 1974: ELF formally changed its name from 'Safrapö.
- 1974: Ashland's first oil discovery at OSSU-1
- 1975: First Oil lifting from Brass terminal by Agip
- 1975: DPR upgraded to ministry of Petroleum Resources (MPR)
- 1976: MPE renamed Ministry of Petroleum Resources (MPR).
- 1976: Pan Ocean Commenced production via Shell-BP's pipeline at a rate of 10,800 b/d
- 1977: Government established Nigerian National Petroleum Corporation (NNPC) by Decree 33 (NNOC and MPR extinguished).
- 1979: Third participation Agreement through NNPC increases equity to 60%.
- 1979: Fourth Participation Agreement, BP's shareholding nationalized leaving NNPC with 80% equity and shell 20% in the joint venture.
- 1979: Changed name to Shell Petroleum Development Company of Nigeria (SPDC)
- 1984: Agreement Consolidating NNPC/Shell Joint Venture
- 1986: Signing of Memorandum of Understanding (MOU)
- 1987: First Participation Agreement (NNPC = 60%, Shell = 30%, ELF = 5%, Agip = 5%)
- 1991: Signing of revised memorandum of understanding and joint venture Operating Agreement (JOA).

- 1993: Production Sharing Contracts signed.
- 1993: Sixth participation Agreement (NNPC = 53%, Shell = 30%, ELF = 10% Agip = 5%)
- 1993: The coming on stream of ELF's Odudu blend, offshore OML 100.
- 1995: SNEPCO starts drilling first exploration well
- 1995: NLNG Final Investment Decision taken
- 1999: NLNG's first shipment of Gas out of Bonny Terminal
- 2000: NPDC/NAOC Service Contract signed
- 2001: Production of Okono offshore field.
- 2002: New PSCs agreement signed liberalization of the downstream oil sector. NNPC commences retail outlet scheme.
- 2004: Project PACE (NNPC's transformation initiative) was commenced.

Appendix 5: Questionnaire Administration

Department of Management,
Faculty of Business Administration,
University of Nigeria
Enugu ó Campus
Enugu
30th April, 2007

Dear Sir/Madam,

This study is being carried out to investigate the diffusion and adoption of Information and Communication Technologies in the management of the NNPC and its subsidiaries. It is purely an academic exercise in partial fulfillment of the requirement for the award of Doctorate Degree in Management of the University of Nigeria. For the purpose of this study, please be informed that no name of any employee will be identified in the result of the study. It would therefore, not be necessary for you to write or sign your name.

The researcher guarantees strict confidentiality of each respondent. Your participation in this study is highly appreciated.

Yours faithfully,

Nathaniel C. Ozigbo

QUESTIONNAIRE

Please tick (x) in the appropriate boxes to indicate your answer

1. Sex: a. Male [] b. Female []
2. Marital status:
 - a. Single [] b. Married [] c. Divorced []
 - d. Widow []
3. Religious Affiliation:
 - a. Christian [] b. Islam [] c. Traditional []
 - c. Others (Specify) : í í í í í í í í í í í í í í í í í
4. Which age bracket do you belong?
 - a. 20-29 [] b. 30-39 [] c. 40-49 []
 - d. 50-59 [] e. 60 and above
5. Educational qualification:
 - a. Ph.d [] b. M.sc [] c. B.sc []
 - d. HND [] e. ND/NCE [] f. WASC/GCE []
 - g. Professional Qualification (Specify) í
6. Working Department:
 - a. Finance and Accounts [] b. Production []
 - c. Marketing [] d. Administrative []
 - e. Others (Specify) í ...
7. Monthly salary
 - a. Less than N100,000 [] b. N100,000-N200,000 []
 - c. N200,000-N300,00 [] d. N300,000- N400,000 []
 - e. N400,000 ó 500,00 [] f. N500,000 and above []
8. Which cadre do you belong in your company's organization structure?
 - a. Junior cadre [] b. Supervisor []
 - c. Middle Manager [] d. Top Management []
 - e. Others (Specify): í í í í í í í í í í í í í í í í í í í ..
9. How many years have been working with the company?
 - a. Less than 6 years [] b. 6 ó 10 years []
 - c. 11 ó 15 years [] d. 16- 20 years []
 - e. Above 20 years []

10. To what extent does the use of APER Form for staff appraisal motivate staff for improved productivity?
- a. Very much [] b. Much []
c. Not so much [] d. Never []
e. No idea []
11. Which of the following methods of training does your company employ most?
- a. On-the-job-training [] b. Interesting []
c. All of the above [] d. No idea []
e. Others(s) (Specify) í í í í í í í í í í í í í í í í í í í ..
12. Based on the training you have attended so far, how would you assess your job?
- a. Very interesting [] b. Interesting []
c. Boring/uninteresting [] d. Difficult []
e. No idea []
13. To what extent does the APER Form stress the strength of individual staff of the organization?
- a. Very great [] b. Great []
c. Little [] d. Very little []
e. No idea []
14. Do you think it is necessary to conduct performance appraisal on a regular basis?
- a. Very necessary [] b. Necessary []
b. Not so necessary [] d. No idea []
e. Others (Specify): í .
15. To what extent are the companies training programme consistent with your career plan?
- a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent []
e. To a very small extent []
16. To what extent is the application of ICT necessary for staff development?
- a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent []
e. To a very small extent []
17. To what extent have the training programmes helped you to acquire skills in information Technology?

- a. To a very large extent [] b. To a large extent []
 c. Neutral [] d. To a little extent []
 e. To a very small extent []
18. To what extent have these skills acquired in Information Technology programmes helped to improve job performance?
 a. To a very large extent [] b. To a large extent []
 c. Neutral [] d. To a little extent []
 e. To a very small extent []
19. Do you agree that knowledge in ICT should be the basis for staff promotion?
 a. Strongly agree [] b. Agree []
 c. Undecided [] d. Disagree []
 e. Strongly disagree []
20. The company's Information Technology training should be enriched?
 a. By provision of additional facilities []
 b. by provision of basic facilities []
 c. By maintenance of old facilities []
 d. By request or new facilities []
 e. No idea [] f. All of the above []
21. To what extent would you say the company's Information Technology programmes are consistent with the objectives?
 a. To a very large extent [] b. To a large extent []
 c. Neutral [] d. To a little extent []
 e. To a very small extent []
22. To what extent do you think regular Information Technology training programmes contribute to in efficiency and productivity?
 a. To a very large extent [] b. To a large extent []
 c. Neutral [] d. To a little extent []
 e. To a very small extent []
23. Does the in-service training programme on ICT provide sufficiently for the training needs of staff?
 a. Very sufficiently [] b. Sufficiently []
 c. Insufficiently [] d. Very insufficiently []

24. Do you think performance appraisal on ICT acquisition will make staff put in their best in the discharge of their duties.
- a. Very much so [] b. Much [] c. Little []
d. Very little [] e. No idea []
25. How would you rate your company's Information Technology training programmes?
- a. Excellent [] b. Good [] c. Fair [] d. Poor []
e. No idea []
26. How computerized do you consider your department to be?
- a. Fully computerized [] b. Partially computerized []
c. Not computerized at all [] d. No idea []
27. What are your plans for the future?
- a. To pursue conventional education []
b. To pursue informal/vocational education []
c. To spend my life with the company []
d. To seek other employment for better incentives []
e. Uncertain []
28. To what extent do you think Information Technology training programmes are adequately harnesses?
- a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent []
e. To a very small extent []
29. How do you evaluate the data storage of your company since computerization?
- a. Very efficient [] b. Efficient [] c. Not Efficient []
d. Poor [] e. No idea []
30. Do you think that the adoption of ICT has affected the services rendered by your company?
- a. Very significantly [] b. Significantly []
c. Not significant [] d. Not at all [] e. No idea []
31. To what extent has ICT system reduced the cost of your company's services?
- a. To a very large extent [] b. To a large extent []
c. To a little extent [] d. To a very little extent []
e. No idea []

32. To what extent has ICT adoption made information storage and retrieval more efficient in your company?
a. To a very large extent [] b. To a large extent []
c. To a little extent [] d. To a very little extent []
e. No idea []
33. When compared with the oversea information Technology training programme, to what extent would you say that in-house training in IT is achieving the objectives for which it was established?
a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent [] e. To every little extent []
34. Apart from Information Technology programme, what other means does your company employ in developing its staff?
a. Job rotation [] b. Cross posting overseas []
c. Training assignment [] d. Leave relief duties []
e. Other(s) (Specify): í
í í
35. In what areas do you think the greatest success in ICTs programmes have been achieved?
a. Administration [] b. Engineering []
c. Exploration and production []
d. Research and Development []
e. Other(s) (Specify): í
í í
36. To what extent can you conveniently say that the oil industry has realized its overall manpower development goals through ICTs training and development programmes?
a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent []
e. To a very little extent []
37. To what extent have the ICTs training programmes you have attended offered you the opportunity to meet your career expectations?
a. To a very large extent [] b. To a large extent []
c. Neutral [] d. To a little extent []

- e. To a very small extent []
38. To what extent do you think that your company has so far achieved its objectives of developing its workforce to meet its Corporate goals as well as the individual development goals?
- a. To a very large extent [] b. To a large extent []
- c. Neutral [] d. To a little extent []
- e. To a very small extent []
39. Considering the huge financial involvement, to what extent would you say that the idea of ICTs training and development in your organization is viable?
- a. To a very large extent [] b. To a large extent []
- c. Neutral [] d. To a little extent []
- e. To a very small extent []
40. To what extent are workers involved in decision-making?
- a. To a very large extent [] b. To a large extent []
- c. Neutral [] d. To a little extent []
- e. To a very small extent []
41. Under which of these management styles do you think workers in your company will be motivated to perform high?
- a. Authoritarian management style []
- b. Benevolent/paternalistic management style []
- c. Participative management style []
- d. Consultative management style []
- e. No idea []
42. Which of the following means do you consider appropriate for improving the company's productivity?
- a. Monetary incentives []
- b. Appreciation of workers potentials []
- c. Delegation of authority to subordinate(s) []
- d. Using coercive measures [] e. All of the above []
43. What are your bases of information when making vital decision?
- a. Historical data of the company [] b. Personal intuition []
- c. Analysis of the situation [] d. Experience []
- d. Using coercive measures [] e. All of the above []

44. How can you rate the effectiveness of the company's decision-making process in ICTs diffusion and adoption?

a. Excellent [] b. Very good [] c. Good []

d. Poor [] e. No idea []

45. State briefly suggestions, which you think, could improve the company's Information Technology training and development programmes

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