

## **The Adoption of Information and Communication Technologies in the Management of Nigerian Oil and Gas Industry**

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**Abstract:** *This study aimed at investigating the need for the adoption of Information and Communication Technologies (ICTs) in the management of Nigerian Oil and Gas Sector. The study brought to the fore critical issues relating to the ICTs prevailing in the oil industry. The study was conducted through survey and archival studies were carried out to identify some of the technical changes and technological capabilities of the Nigerian Oil and Gas Industry. Data used in the study was collected from primary sources through structured questionnaire and interviews with the users of ICT components. The data collected were analyzed using Analysis of Variance (ANOVA) technique. The study provided empirical evidence that the adoption of ICTs in the Oil and Gas industry 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 the sector from foreign competitors and that obsolete equipments for training should be scrapped.*

**Keywords:** *Information and Communication Technologies are beneficial to the Oil and Gas Sector.*

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### **1. INTRODUCTION**

A growing number of corporate organizations have recognized the high potential of information and communication technologies (ICTs) to contribute to national and social development. Information and communication technologies have a critical role to play in development efforts around the world. There was a time when the benefits of applying ICT in fighting poverty and promoting economic growth were not widely understood. Many in the developing community questioned how communication technology could be used to alleviate such dire challenges as starvation, Homelessness and lack of basic education and health services. Recently, this view has given way to an understanding of ICT as an essential component of boarder efforts to harness the free flow of information, accountability and economic development. In the recent time, both the developing countries and the international communities have started taking concrete actions to incorporate ICT into their economic policies and development agenda. The Millenium Development Goals (MDGs) drawn from the United Nation Millennium Declaration and adopted in September 2000 have several specific targets using ICT as a tool for reducing poverty and improving the efficiency of corporate organizations.

Against this backdrop, the researcher considered it necessary to investigate the adoption of Information and Communication Technologies (ICTs) in the management of the Nigerian Oil and Gas industry. The advent of information and communication technologies have a huge impact on the way organizations of all types and users perform their work (Kunti:1996). What has become known as the Information and Communication Technologies (ICTs) revolution have improved efficiency and effectiveness in most sectors of the economy. By allowing organizations to create and analyze important new information, it changed the way major decisions were made. (Rocheleau 1999).

In the eyes of many during long years that passed, the thought of information and communication technologies in 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 and Communication Technologies (ICTs), especially in the Non-Governmental Organization (NGOs) sector. These days the very people who shared the traditional thoughts are thinking differently. Most are now convinced that ICTs without result are waste of time.

## **2. STATEMENT OF PROBLEM**

The trust of this study is on the nature of magnitude of the adoption of Information and Communication Technologies in the management of the Nigerian Oil and Gas Industry. It is increasingly recognized that the development, adoption of ICTs are key determinant to success or failure in the management of the Nigerian Oil and Gas industry. In this study, it became pertinent to find out if Oil and Gas industry 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 industry.

## **3. OBJECTIVES OF THE STUDY**

The main objective of this study is to investigate the nature of the adoption of Information and Communication Technologies in the management of Nigerian Oil and Gas Industry. Other specific objectives include;

- To examine the core capabilities of the industry production, investment, linkages and strategic marketing to see if they encourage ICTs adoption.
- To study the impact of technical changes and government economic policies on the performance and capacity of the industry to acquire, develop and update these technologies.
- To investigate the need for strong and dynamic technological adoption in achieving economies of scales and mass production.
- To examine whether the telecommunication services are effective as growth and productivity instrument.

## **4. RESEARCH QUESTIONS**

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

- Do the core capabilities in Nigerian Oil and Gas industry on production, investment and strategic marketing encourage the adoption of ICTs?
- To what extent do technical change and government economic policy affect Oil and Gas Industry to acquire, develop and upgrade these technologies?
- To what extent is the need for strong and dynamic technological adoption in achieving economies of scale in the operations of the Nigerian Oil and Gas industry?
- To what extent are telecommunication services in the Nigerian Oil and Gas Industry effective as growth and productivity instruments?

## **5. RESEARCH HYPOTHESIS**

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

- i)  $H_0$ : The core capabilities in the Nigerian Oil and Gas Industry on production, investment and strategic marketing do not encourage the adoption of information and communication technologies.

$H_A$ : The core capabilities in the Nigerian Oil and Gas Industry on production, investment and strategic marketing encourages the adoption of information and communication technologies.

- ii)  $H_0$ : Strong and dynamic technological adoption does not facilitate the achievement of economies of scale in the operations of the Nigerian Oil and Gas Industry.

$H_A$ : Strong and dynamic technological adoption facilitate the achievement of economies of scale in the operations of the Nigerian Oil and Gas Industry.

## **6. SIGNIFICANCE OF THE STUDY**

The significance of this study cannot be over-emphasized, when one considers the resultant effects of inadequate access of Information and Communication technologies in the Nigerian Oil and Gas Industry. The study might help to put the theory of adoption of ICTs into practical application. This process might help to verify the claims of the theory and consequently come out with the strength and weaknesses of the theory. This study is hoped to break an academic exposure, thereby closing a gap in academic literature and as such a major contribution to knowledge. The study is also significant because it create the much needed awareness of adoption principles as a management concepts that the management of Nigerian Oil and Gas industry should embrace in order to improve the quality of their services. This study is also important for encouraging the spirit of the adoption of new approaches that undoubtedly provide long-term benefits and enhance local prospects and development. The outcome of this study would 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 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 oil and gas industry.

## **7. CONCEPTUAL FRAMEWORK**

The conceptual framework for this study was premised on the prevailing environment in Nigeria organizations, especially the Nigerian Oil and Gas Industry. The study adopted the firm level technological capabilities framework defined in Ernest, Nytelka and Ganiastsos (1994). The definition of technological capabilities was based on the concept 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 challenge 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 include such items as engineering blue prints and designs and the underlying genesis of scientific knowledge. It also includes management manuals, handbooks, features, performance requirements, material specifications and quality assurance criteria. Tacit knowledge is derived from and tired to the localized and collective learning experience of a given company through technological capabilities.

A growing literature on Information Technology adoption suggests that there are 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, assist achieve and maintain international competitiveness, enable environmentally friendly development. One unprecedented opportunity, that ICTs have opened to the society include access to global knowledge at an increasingly low cost. Even the most remote countries are now connected to knowledge and data banks, 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 as indicated by Adeyinka (1996) is key to competitiveness and economic growth of our time. Progress in information and communication technologies no doubt have the greatest influence on the global economy. This made it possible to collect process and transmit information at breath-taking speed and declining cost, thereby increasing productivity, improving quality and efficiency.

The information revolution is currently sweeping through our economy. No sector can escape its effects. Dramatic reductions in the costs of obtaining, processing and transmitting information are changing the way we do business. Wareen (1994) emphasizes that information evolution affects competition in three vital ways:

- It changes industry structure and in so doing, alters the rules of competition.

- It creates competitive advantage by giving companies new ways to out-perform their rivals.
- It spawns whole new business from and within a company's existence.

In essence, information and communication technologies generate more data as company performs its activities. Such technologies made available for a more comprehensive analysis. Chandler (1977) states that the new technology has a powerful effect on competitive scope, creates many new inter-relationships among businesses and expand the scope of industries in which a company compete to achieve competitive advantage. Information and communication technologies not only transfer products and processes. Warren (1994) indicates that it is very likely that ICTs play a strategic role in an industry and provide windows of opportunities 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 be indispensable for achieving international competitiveness in an increasingly integrated information global economy.

Development in Information and Communication Technologies (ICTs) have been among the fastest growing business in the world. The question is how the Nigerian Oil and Gas Industry with its enormous potentials continue to remain a sleeping giant? Recognizing the potentials of information and communication technologies (ICTs) to transform development, it has become obvious that the information revolution have not been made available to all institutions in Nigeria. The telecommunication infrastructure is 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 poses major difficulties in introducing, implementing and diffusing the new technologies for inter-networking. The path of 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 target at developing and empowering of Information Technology facilities for the various levels of the educational system to support the necessary restructuring to cater for the challenges of the information age.

This section examines the key challenges in the Nigerian Oil and Gas Industry centred 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, the thrust is strengthened by the recognition and submission of the fact that the above vision could only be timely and meaningfully accomplished if we could restructure the industry to be science and technology based, to be creative and to be globally competitive. The simple truth today is that no nation can effectively succeed in solving her 21<sup>st</sup> century development challenges unless the national vision, aspirations, 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.

Oil currently accounts for about 90 percent of Nigeria's exports and is the bedrock of the Nigerian economy (Onoh 2000). Nigeria real-time economic performance is largely tied to world oil prices. Given Nigeria's huge oil reserves, the high oil prices have resulted in a booming of Nigerian economy, and information technology has also drastically reshaped the economy, especially the Nigerian oil industry. The revolution of information technology in Nigeria has created highly skilled IT workers in the Oil and Gas industry, and has affected the way we live, work and play. The technology has enabled communication network become the predominant means of interaction between individuals, businesses, organization and government. The growing incidence of IT application has provided the strategic reserve needed to support surge and mobilization requirements as needed therefore, to maintain its global leadership in oil supply, the Nigerian Oil and Gas Industry should invest in the IT work force and ensure that they find the right person with the risk skills at the right time.

Information and communication technologies have been identified 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 the citizenry. Information and communication technologies have the potential to create earnings opportunities and jobs, improve delivery and access to health/education, facilities information sharing and knowledge creation. The study noted that the diversity of the country's resources and a tectonic change in the foundation of the global economy

created reasons for optimism in the nation's potential for highly skilled intellectual capital. The study noted that strategies have to be put in place to bridge the digital divide.

## **8. DEVELOPMENT OF OIL AND GAS INDUSTRY IN NIGERIA**

The history of oil exploration in Nigeria date back to 1908, when a Germany entity, the Nigerian Bitumen Corporation commenced exploration activities in Araromi area of Ondo State, Nigeria. These pioneering efforts ended abruptly with the outbreak of the First World War. Oil prospecting efforts resumed in 1937, when Shel D'Avey (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 efforts after several years led to the first commercial discovery in 1956 at Oloibiri, Bayelsa State. This discovery opened up the oil industry in 1961, bringing 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. The multinational oil companies operating in the country bore the risk and cost of exploration, development, production and acquired titled 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 department of petroleum resources and the Nigerian Petroleum Refining Company (NNPC) 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 operations of multinational companies, which had dominated the business before now. In 1971, government exercised its option of taking 33  $\frac{1}{3}$  percent equity interest in Nigeria Agip Oil Company. In the same year, government established her sovereign rights and 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 active roles in the oil industry of their respective countries in order to facilitate the transfer of technology, skill and experience. The Nigeria 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.

The decree established NNPC, as a public organization that would on behalf of government, adequately manage all government interests in the Nigerian Oil Industry. In addition to its exploration activities, the corporation was given power and operational interest 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 Maiduguri. 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 progressively moved offshore Nigeria.

The formation of the Nigerian National Petroleum Corporation (NNPC) in 1997 was an off shot of different developments in the country's oil industry. NNPC was formed throughout 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 Directorates, 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 hydrocarbon 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 investment;

The corporation has the following wholly-owned subsidiary companies :

- Duke Oil Limited
- Eleme Petrochemical 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 Product Marketing Company Limited (PPMC)
- Port-Harcourt Refining and Petrochemical Company Limited (PHRC)
- Warri Refining and Petrochemicals Company Limited (WRPC)

## **9. STRUCTURE OF NNPC AND ITS SUBSIDIARIES**

NNPC is saddled with enormous national economic and social responsibilities. The survival of the corporations therefore depends 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. According to Onoh (2000:14), the objectives of the government at that period was to:

- Improving supply and distribution performance, thereby eliminating fuel shortage.
- 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 were spent on rehabilitating the refineries. In addition, a sum of \$254,364,232 were spent on rehabilitating pipe lines and depots in the last four years (Akpiayi, 2005:35).

In order to consolidate and sustain the gains of the board 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) licence were issued to prospective investors, while NNPC's monopoly of products supply were 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. Today, NNPC has diversified into retail business through the establishment of mega stations in different parts of the country. 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 reserve 40 billion barrel and productivity of 4.5million barrels per day by the year 2014.

To complement the efforts of joint ventures partners, the NNPC established the National Petroleum Development Company (NPDC) as an exploration and production (E & P) subsidiary. The strategy was to grow NPDC into becoming a world class E & P company. To this end, capacity building was encouraged. In addition, the Nigerian government is actively promoting the internationalization of inputs in the upstream sector. The objectives of the local content policy was to promote value adding in Nigeria through utilization of local raw 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 were 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 technical competent Nigerians in the oil and gas business, providing a spring board for into operation in the less conventional terrain leading to greater opportunities for technological transfer and increased employment generation. The Nigeria economy in general and the oil industry in particular are rapidly transformed for greater efficiency and sustainable growth. The future portends enormous growth and business opportunities. The Nigerian oil industry was poised to exploit those 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 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 notwithstanding has led to social and political unrest, particularly in the Niger Delta.

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 were not unique to Nigeria. Mineral exports tend to suffer from a cluster of economic and political ailments (Aunty, 2001:75). Recent econometric studies show that states that depend on mineral exporters tend to have a typically slow economic growth. In essence, the volatility of the oil sector produces volatility in government revenue. The more that the government relies on oil, the greater the impact that oscillations in oil prices might have on the government.

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

### **10. RESEARCH METHODOLOGY**

This section of the study highlights the various methods of collecting and analyzing data. The methodology adopted involve extensive literature search. The search was completed with interviews and visits to the industry. The information gathered from these different sources were subjected to content analysis. Where disagreements were observed in data from different sources on the same subject, visits were repeated for clarification and consistency.

By involving other colleagues in this study, it was possible to tap the experience and expertise of others. Questionnaires 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 of questionnaire were discussed with senior executive involved with the study. Each items of the questionnaire was considered, relevant changes were made and omissions identified. The amended questionnaire was sent to the respondents who were asked to fill in the questionnaire and give their feedback.

The survey covered broad aspect of the study issues such as the technological learning, firm history and the impact of technical changes on performance. The survey covered broad aspect of the study issues such as the technological learning, firm history and the impact of technical change on performance.

The total workforce of the Nigerian oil and gas industry formed the population of the study. Available record put the staff strength at 10,000 personnel (NNPC Annual Report 2009).

Furthermore, determining the appropriate sample size for the study was an essential step in the statistical design of the study. The sample size for 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  
 e = Margin for error

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

$$n = \frac{10,000}{1 + (10,000) (0.05)^2}$$

$$n = 385.61$$

The sample size for the study was rounded to three hundred and eighty six respondents. Also, the researcher adopted simple random technique where each member of the respondents had the same chance of selection.

Data collected from the study was classified into different groups with the aid of tables. The chi-square analysis and the Analysis of Variance (ANOVA) were used to test the hypotheses.

### **11. INSTRUMENT VALIDITY AND RELIABILITY**

The essence of establishing the validity and reliability of the research instrument was to ensure that the instrument objectively measure what it seek to measure. In this case, validity is the extent of which the information represents that it intended to achieve. 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 measurement. The test and re-test methods were used to determine the reliability of the instrument. The calculated alpha coefficient fell within the range of 0.70 to 0.90

### **12. DATA ANALYSIS AND FINDINGS**

The analysis looked at:

- How much and what kind of ICTs were used by the managers and staff of the Nigerian.
- Factors associated with different patterns of ICTs used.
- The extend to which the managers and staff are satisfied with ICTs used in their organizations/units.

#### **1. ICTs Use by Managers and Staff of the**

This section of the study evaluated the factors associated with ICTs used in the Oil and Gas industry. From the analysis, we found that there were considerable variations in ICTs used among the different kinds of staff represented in the study. In the study, factors that were related in ICTs use pattern were grouped into three categories; namely:

- Individual characteristics of managers
- Organizational characteristics, such as size and mission
- Staff programme characteristics

**Table 1.** Below indicate the potential factors that influence ICTs used at individual level

Sex	Male		Female	
	University Degree		No University	
Computer skill	poor	fair	good	excellent
Computer	Between 5 years and	5 – 10 years	11 – 15 years	Greater than 15



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experience	more than ten years			years
Job experience	Less than 5 year	5 – 10 years	10 – 15 years	Greater than 15 years

Source: Survey Data

### 2. Profitability Analysis

In the course of the study, factors that enhanced profitability were considered in measuring the impact of ICTs adoption on the Nigerian Oil and Gas Industry. These factors include:

- Cost of ordering (processing)
- Raw materials and other inputs
- Inventory Keeping
- Other products costs

**Table 2.** Profitability levels before and after ICTs adoption

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

Source: Survey Data

From the analysis, it was found that when the adoption of ICTs reached a significantly high level, 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 was enhanced by an average of 12 percent per year as a result of the adoption of ICTs by the Oil and Gas Industry. In other words, it could be concluded that the adoption of ICTs increased the profitability prospects of the industry by as much as 12 percent per year as a result of the adoption of ICTs by the Oil and Gas Industry. In other words, it could be concluded that the adoption of ICTs increased the profitability prospects of the industry by as much as 12 percent.

### 3. Analysis of Local Technology and Fabrication used in the Industry

The occurrence of technique change in the Nigerian Oil and Gas Industry was observed in the local technology and fabrication used in the Turn-around maintenance (TAM) operations. The study revealed that the Petroleum Training Institute (PTI) located near Warri designed and constructed most of the cranes used for moving heavy machinery, a prototype mechanism of the blower used for raising and lowering burner buckets and a modified wheel barrow. The indigenous oil service companies mainly provided other local technologies used in the oil industry. These technologies consists of the design and fabrication of mattering stations for oil companies calibrating of oil tools and instruments such as flow meters, prone loops and furnace for melting stell and alloys.

### 4. Test of Hypotheses

Two 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 Nigerian Oil and Gas Industry.

#### Hypothesis 1

H<sub>0</sub>: The core capabilities of the Nigerian oil and gas industry on production, investment and strategic marketing do not encourage the adoption of information and communication technologies.

H<sub>A</sub>: The core capabilities in the Nigerian Oil and Gas Industry on production investment and strategic marketing encourage the adoption of information and communication technologies.

**Table 3: Management Levels**

Department	Top Management	Middle Management	Supervisors	Junior	Total
Finance/Accounts	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

**Table 4. ANOVA Table**

Variation	Degree of Freedom	Sum of Square	Mean Square	F-ratio
Explained 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	$\frac{216.0}{103.145}$ = 2.097

$Df = (c - 1)$  and  $(r - 1)c$   
 $= (4 - 1)$  and  $(4 - 1)4$

Given that  $\delta = 0.05$

$F(0.05) = (3, 12) = 3.49$  (Critical value)

Since  $3.49 \geq 2.097$ , we accept the null hypothesis which states that the core capabilities in the Nigerian Oil and Gas Industry on production, investment and strategic marketing do not encourage the adoption of information and communication technologies.

**Hypothesis 2:**

$H_0$ : Strong and dynamic technological adoption do not facilitate the achievement of economies of scale in the operation of the Nigerian oil and Gas Industry.

$H_A$ : Strong and dynamic technological adoption facilitate the achievement of economies of scale in the operation of Nigeria Oil and Gas Industry

Department	To a very large extent	To a large extent	Neutral	To a small extent	To a very small extent	Total
1	41	37	13	28	19	138
2	25	31	11	21	14	102
3	26	20	6	18	12	82
4	21	18	4	12	9	64
Total	113	106	34	79	54	386

Source: Survey Data

**Table 5. 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 $\frac{MST}{MSE} = \frac{216.30}{47.63}$ = 5.9
Errors or unexplained (within columns)	$(r - 1)c$ $(5 - 1) 5 = 15$	SSE = 714.48	MSE = 47.63	

$Df = (c - 1)$  and  $(r - 1) c$   
 $= (5 - 1)$  and  $(4 - 1) 5$

4 and 15

Given that  $\delta = 0.05$

$F(0.5) = (4, 15) = 3.06$  (Critical Value)

Since  $3.06 < 5.9$ , we reject the null hypothesis which states that strong dynamic technological adoption do not facilitate the achievement of economies of scale in the operations of the Nigerian Oil and Gas Industry

### **13. SUMMARY OF MAJOR FINDINGS**

This study provided an empirical evidence that the adoption of ICTs in the management of Nigerian Oil and Gas Industry were very beneficial. It was found that the staff of the industry needed additional training in information technology so as to cope with the general information usage and 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 resources departments were in charge of organizing training programme in information technology. The study also identified that the history of oil exploration in Nigeria might not have been possible if not for the effort of the early foreign investors who in the face of many risks took the step to explore the nation's oil. Apart from the fact that the nation did not have the technology required for the operation, the capital needed for such investment were enormous for a developing country like Nigeria to afford. The decision to allow foreign investors to take the lead was a welcome idea.

The study found that technology acquisition mechanisms could best assist the Nigerian oil and gas industry to achieve sustained development. The study identified that if the Nigerian Oil and Gas Industry should develop the needed capacity to face the technological challenge of the 21<sup>st</sup> century, they should establish institutional structures, articulation of policies and monitor their implementation. Many laudable policies, programs and institutions in the past have been hampered or rendered counter productive by gross incompetence, lack of coordination, bureaucratic pphlegmatism and corruption.

The study advocate for an urgent need to redefine, update and refocus our national development strategies to critically address ICTs interventions in four critical areas:

- Infrastructural development
- Rural community development
- Public-private sector partnership
- Good governance and legislation

We observed that over the years, ICTs related issues have not been accorded attention they deserves as the catalyst of change for national development. The simple truth today is that no nation can effectively succeed in solving the 21<sup>st</sup> century development challenges unless the nation's vision, aspirations, 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.

### **14. RECOMMENDATIONS**

On the basis of the findings of this study, the following recommendations were made to facilitate the adoption of ICTs in the Nigerian Oil and Gas Industry.

- Appropriate laws should be enacted to protect Nigeria's oil industry from foreign competitors, especially as local markets are open up to outside investment.
- There is need for the government to allocate special funds to its oil agencies annually or quarterly for the purchase of training facilities.
- Obsolete equipment for training should be scrapped. Proper maintenance of equipment and available technicians should be made available.
- It is essential to install communications and information infrastructures capable of supporting the creation and sharing of information and knowledge.
- Need for the establishment of research parks for ICTs programs.

## 15. FUTURE RESEARCH DIRECTIONS

Further research is required to expand and refine the theoretical basis of social and cultural levels of the adoption of information and communication technologies in the Nigeria. Extensive in-depth case studies are also required to better understand the effects of social and cultural levels of information communication technologies, such studies should be conducted using research approaches that challenges the positivst tradition that underpin much of information systems. Researchers are encouraged to test empirically the research work as embodied in this study, conduct an in-depth interviews to ascertain the findings and provide antidotal evidence. The assessed significant linkages would be useful in providing better understanding of the results.

## REFERENCES

- Adeyinka, F. M. (1996) "An Explanatory Study of the Structure, Capacity and Capabilities of Electronic Firms in Nigeria". Nigerian Institute of Social and Economic Research (NISER), Monograph, No. 8, Ibadan.
- Chandler, A. D (1977) "Information Technology: The Visible Hand, a new comparative weapon" "Sloan Management Review, Cambridge, Belknap Press Pp. 77-96
- Ernest, D. Mytelka, L. and Gancastsos T. (1994) Technological Capabilities: A Conceptual Framework, Geneva, UNCTAD.
- Kunti K. (1996) Debates in Information System Research, Anticipating System Design for Post Fordist work, Information Technology and Change in Organizational Work, London, Chapman and Hall.
- Onoh, J. K. (2000) The Nigerian Oil Economy from Prosperity to Gulf, New York, Croom Helm.
- Olisa, M.M. (1987) Nigerian Petroleum law and Practice, Ibadan, Fountain Books Ltd.
- Porter, M. E. (1985) "Information Technology Change Competitive Advantage: The way you compete", New York, Free Press, Harvard Business Review, May-June
- Rocheleau, B. (1999) "The Political Dimensions of Information Systems in Public Administration, in D. G. Garsm(ed). Information Technology and Computer Application in Public Administration, 4, Ershey
- Ross, E. O. (2003) Economic for a Developing World, London, Longman Group.
- Waren, E. (1994) "The Information Achipelago, Decision Oriented Information", Harvard Business Review, September – October.