

## ECONOMIC VALUE OF ICT INVESTMENT IN NIGERIA: IS IT COMMENSURATE?

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### ABSTRACT

*This paper explores the economic value of ICT investment in Nigeria. Data were gathered from secondary sources after which different statistical packages were used to extract relevant information. Investigation revealed that ICT investment was on the increase from 2001 when the telecoms industry in Nigeria got their liberalization. The empirical results suggest that ICT investment has a significant impact on Nigeria's economic growth during the period reviewed, suggesting good payoffs from the investment. R-squared result shows that a high proportion (95%) of total change in GDP is accounted by private investment in ICT, ICT contribution to GDP and number of subscribers. ICT investments made by the private sector seem to have contributed significantly to the country's growth. However, in order to sustain economic growth leveraged against ICT, more concerted efforts need to be made to increase ICT investment diffusion in the country. Such initiatives will ensure that the value potential of ICT investments in the economy is maximized, due to greater ICT-enabled potential that can translate to economic growth.*

**Keywords:** Private Investment, Unemployment, ICT

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### 1.0 INTRODUCTION

In spite of the 2001-02 worldwide economic gloom, the rapid pace of technological progress has not been arrested. The technological revolution in information and communication technologies (ICT), which has contributed to the extraordinary performance of the US economy in the late 1990's (Jorgenson and Stiroh 2001, Oliner and Sichel 2000, Stiroh 2002) and in 2000-03 (Economist 2003), has not slowed down. The rapidly falling prices of ICT products and services along with their increasing efficiency and quality encouraged users to invest in ICT. After the slowdown in ICT investments recorded during the past two years, the growth in ICT spending is picking up again. Aside from the USA, the use and/or production of ICT have contributed to an increase in the rate of productivity and economic growth in a number of developed and developing countries in the late 1990's. Among the former, Australia, Sweden, Finland, and Ireland seem to have tapped the 'new economy' to the largest extent (OECD 2001a, Jalava and Pohjola 2002, Daveri 2002). Among the developing countries, Malaysia, Philippines, Thailand, South Korea, and Taiwan benefited from the production of ICT (IMF 2001). Evidence about the contribution of Information and Communication Technologies (ICT) investment to productivity and growth has been very controversial. In developed countries and especially among the G-7 countries, ICT investment has a large impact on productivity growth. In developing countries, this controversy still persists. Information communication technology has been recognised as one of such factors for the past two decades has a driving force for most developed countries' economies. The Industrial Revolutions in Europe and America have been driven by technological breakthroughs. During the late 1990s, Information and Communication Technology (ICT) was the largest contributor to growth within capital services for both Canada and the United States (Harchaoui, 2002). Also, similar trend has been observed with the economic development of other Asian countries like the China, Korea, India and other emerging economies (Mafe, 2000). In the case of Nigeria, impacts of ICTs have been noted to influence the environment, employment, poverty alleviation,

attraction of foreign direct investment, and empowerment for the disabled. According to Akwani (2005), the fastest growing employer of labour in Nigeria today is the telecom industry (Specifically, the wireless telephone sector that provides services to individual customers using the GSM).

ICTs are embedded in networks and services that affect the local and global accumulation and flows of public and private information. According to the United Nations Economic Commission for Africa (1999), ICTs cover Internet service provisions, telecommunications and information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities. The Commission admits the definition as being quite expansive. It is not uncommon to find definitions of ICTs that are synonymous with those of information technology (IT). Drew and Foster (1994) defined IT as the group of technologies that is revolutionising the handling of information. It is taken to embody a convergence of interest between electronics, computing and communication. Chowdhury (2000) posited that ICTs encompass technologies that can process different kinds of information (audio, video, text, and data), and facilitate different forms of communications among human agents, and among information systems. Duncombe and Heeks (1999) simplify the definition by describing ICT as an “electronic means of capturing, processing, storing, and disseminating information”.

Information Technology is the defining tool of the emerging information economy. Information and Communication Technologies (ICT) promises to create new sources of value and redefine industry boundaries. But it also threatens to absorb millions of scarce investment dollars for ill-conceived ICT projects. Information creates business value only if it leads decision-makers to take actions they would not otherwise have taken. Information and Communications Technologies (ICT), and particularly the Internet have been credited with enormous contribution to the growth of the developed economies of the world and other emerging economies. The impact of ICTs is not a single, stable and predictable outcome, but a non-linear, ongoing process that changes and evolves over time as the actions of individuals and groups within an organization are not wholly determined by outside forces: people can and do react to, and shape, systems in different ways (Kimble and McLoughlin, 1995).

In 2000, the Federal Government of Nigeria embarked on an aggressive drive towards the provision of more efficient ICT services in the nation and also investment in ICT through its privatization and deregulation policies. The policy success led to the establishment of National Telecommunication Policy in December 2001. The policy recognised the need for the establishment of an enabling environment for deregulation, rapid investment in ICT and rapid expansion of the telecommunication services in the country. The mission statement of the government was to use ICTs for education improvement, creation of wealth, poverty eradication, job creation, global competitiveness etc. The policy objective was to develop globally competitive quality manpower in ICTs and its related disciplines. Since the ICT revolution in Nigeria in 2000, there has been a progressive impact on the economic growth in terms of women empowerment, organizational growth, employment generation, in banking sector (in banking operations in terms of adoption and implementation of information technology devices, innovative technologies etc), construction industry. In the past decade, there have been a number of private direct investment in ICT and government investment. However, in this work our major focus is on the economic value of these investments. Are they commensurate? What has been their impact? What is the relationship between economic growth and investment in ICT? These are some of the questions we shall answer in this work.

The amount of money/capital that countries spend on ICT keeps increasing, yet they continue to ask questions like: What are we getting for this money invested? Are there any progress? Is there any difference between when we invest and when we didn't invest in ICT? While there are many countries generating value from investing in ICT, many other countries are questioning whether business or economic value realized is commensurate with the level of investment? In the case of Nigeria, are the huge investment made by both private and public sector commensurate in terms of their return on investment? What are the policies put in place to ensure that return on investment is made possible?

Therefore, this paper seeks to empirically measure the economic value of ICT investment in Nigeria and see whether it is commensurate. If commensurate, how then can it be improved upon and sustained by the government. To this end, the specific objective is to:

- (i) Evaluate the contribution of ICT investment to economic growth in Nigeria

## 1.1 REVIEW OF LITERATURE AND THEORETICAL ANALYSIS

In the last thirty years, several studies have been undertaken to examine the impact of ICT on a country's economic performance, fuelled largely by Robert Solow's (1957) seminal work. In the paper, Solow argued that the United States (US) economic growth during 1950s and 1960s was attributed mainly to 'technological

change' as opposed to the conventional factors of labour and capital. Since then, various firms, industry and country level studies have been undertaken on this issue. The studies are carried primarily for developed countries while developing countries have been studied more recently. For an empirical study, we will review some of the key studies that have examined the impact of ICT on economic growth both in developed and developing countries. Studies for developed economies have commonly employed the Cobb-Douglas production function to estimate the contribution of the ICT investment to economic growth. The conclusions drawn from these studies are mixed (some found positive impact while others found negative relationship).

In the context of negative findings, Berndt et al. (1992) examined the contribution of ICT capital to US industries' productivity growth and found a negative relationship. Parsons et al. (1990) argued that Canadian banks did not reap good benefits from their ICT capital investments. Similar findings were reported by Morrison (1997) whom reported insignificant relationship between ICT and economic growth of the US firms. Chowdhury (2000) noted that many skeptics have not seen the role of ICTs in efforts intended to alleviate poverty and bring food security to developing countries. The author acknowledged that the problem of poverty alleviation is complex. Efficient production systems and physical infrastructure are a few of the necessities.

Some of the studies had found positive and significant relationship between ICT and economic growth. In early 1990s, Lau and Tokutsu (1992) investigated the contribution of ICT investment on economic growth in the US for the period 1960 to 1990. The empirical result showed that nearly half of the growth in the aggregate national output in the US was attributed to ICT investment than non-ICT capital or labour. Schreyer (2000) estimated the impact of ICT on labor productivity amongst G7 nations. He found that the employed sample countries (i.e. Germany, Canada, Italy, Japan, US and UK) had benefited significantly from ICT investment in terms of remarkable average annual labour productivity growth over the period 1990 to 1996. Poh (2001) investigated the impact of ICT investment on overall productivity in Singapore over the period 1977 to 1997. The estimated result showed that ICT capital generated significant rate of return to the economy. Two years later, Kim (2003) examined the impact of ICT on productivity and economic growth in Korea during 1971 to 2000 sample period. The results showed that ICT capital contributed 16.3% to the output growth and has had strong positive effect on the growth of labor productivity in the long run.

Several studies have examined the contribution of ICT to economic development of developing countries in recent years. To quote a few, Kuppusamy and Solucis (2005) and Kuppusamy and Shanmugam (2007) examined the impact of ICT to Malaysia over the periods 1975 – 2002 and 1983 – 2004, respectively. It was found that ICT investment has statistically improved Malaysia's economic growth in both studies.

In sum, the issue of ICT and economic growth has received much attention with respect to the developed countries as opposed to the developing countries.

In a series of empirical research studies, Nair and Kuppusamy (2004) and Nair et al., (2005a, 2005b) highlighted the existence of ICT diffusion disparity between developed and developing countries. The key question now is what have the developed countries done to widen ICT diffusion in their country that the developing countries are not doing? In the case of Nigeria, significant investments have been made to integrate ICT into all sectors of the economy. So has the country benefited from such investments in term of economic growth, or it is just a waste of good money? We answer these research questions via the empirical findings from this paper. But first we briefly review Nigeria's efforts to embrace the ICT revolution.

## 1.2 ICT REVOLUTION IN NIGERIA

In order to catch up with more evolved economies, Nigeria undertook several bold initiatives over the last decade, mainly to enhance ICT diffusion in the country. In 1999, the total private investment was more than \$50million and while in 2008 \$12,500million contributing 2.90% to the total gross domestic product in 2008. According to Ndukwe (2004), investment in the telecommunication sector ranks second only to the oil industry. Of all the applications of ICTs, the use of mobile phones is on the increase in most developing countries while internet usage is considered to rank next to phone usage, especially in Nigeria. Specifically, ICT has successfully aided the following sectors of the Nigerian economy: the Industrial/Manufacturing, Education, Transportation, Tourism, Health, Banking, Commerce, Agriculture, Government Services, Defence, Sports, and Rural Development. ICTs played vital roles in the enumeration of the 2006 population census in Nigeria, and the successful hosting of the 15th National Sports Festival, 2006. It is expected that the Network Providers will soon devote their assistance towards research in the higher institutions of learning in Nigeria. According to Akwani (2005), the fastest growing employer of labour in Nigeria today is the telecom industry (Specifically, the wireless telephone sector that provides services to individual customers using the GSM).

An anti-poverty measure introduced through the use of ICT has been able to generate substantial amount of employment through the use of mobile phone by many Nigerian to sustain a living. There are many call centers in villages and towns mostly operated by people between age distributions of between 20-29 years (38%), mostly women with secondary/post-secondary education in Nigeria. Some of these people run shops for the sale of Global System of Mobile (GSM) accessories as a major form of occupation as means of self-employment as well as a means of sustaining livelihood (80% and 84% respectively as shown in Table 9). Past studies have shown that over 2,000 persons are directly employed by GSM operators and an estimated of 40,000 Nigerians are benefiting from indirect employment generated by GSM operators in Nigeria (Ndukwe, 2004). ICTs have also assisted in the area of micro-credits finance and cooperatives. Farmers are now organizing cooperatively to manage their access to market as an alternative to being at the mercy of powerful buyers. Credits are now easily made available to the poor for a better quality of life through such social groups and ICTs. Through the use of ICTs such as the GSM telephone, transaction costs of many Nigerian who are poor have drastically been reduced. People make called before traveling and for business transaction. The technology has led to increase service innovation, efficiency and productivity.

### 1.3 SCOPE OF STUDY

The study will focus on the telecommunication aspect of ICT. This is due to the limitations on data on ICT components in Nigeria.

### 2.0 RESEARCH METHODOLOGY:

#### Research Design and Data Gathering

For this study, secondary data was employed. These data were sourced from the publications of the Central Bank of Nigeria (CBN) and Nigerian Communications commission.

The data relate to the aspects of ICTs and economic development such as investment in the telecommunication sector, gross domestic product, and number of subscribers. This study adopts ordinary least square (OLS) analysis to examine the economic value of investment in ICT on economic growth and development in Nigeria.

### 2.1 ANALYSIS OF DATA AND INTERPRETATION

This study modifies the autoregressive distributed lag (ARDL) framework developed by Pesaran and Shin (1995, 1999), Pesaran et al. (1996) and Pesaran (1997) to model the economic value of ICT investment in Nigeria over the period 1999 to 2009.

#### 2.1.1 MODEL SPECIFICATION

This section present some sample specification of models, which permits the qualification of economic relationship between economic variables. Economic variables such as the private investment in telecommunication, ICT contribution to gross domestic product, number of subscribers are the independent variables while economic growth measured as GDP is dependent variable. GDP will be regressed on private investment in telecommunications, ICT contribution to GDP and number of subscribers.

Our definitional econometric models for this study can be specified as follows:

$$G = f(\text{PI}, \text{IG}, \text{NS}) \dots\dots\dots (i)$$

Where G = Gross Domestic Product (GDP)

PI = private investment in telecommunications

IG = ICT contribution to GDP

NS = Number of subscribers

Following from our theoretical perspective, the models are specified such that we can be able to test for the bivariate economic relationships as stated in the objectives of the study. While the above served as the main model, the following equation is in linear form.

$$G = \alpha + \beta_1\text{PI} + \gamma\text{IG} + \lambda\text{NS} + \varepsilon \dots\dots\dots (ii)$$

In equation (ii), the dependent variable is GDP (G), while the independent variable is private investment in telecommunications measured as total value of money spent on telecommunications (PI), ICT contribution to GDP (IG) and number of subscribers. This study intends to show the effect of ICT investment on economic growth.  $\alpha$ ,  $\beta_1$ ,  $\gamma$ ,  $\lambda$  are the parameters while  $\varepsilon$  is the error term.

## 2.2 THE ECONOMETRICS

This evaluation is to test if the estimated parameters are theoretically and statistically meaningful and significant. This study makes use of ordinary least square method (OLS), under which the criteria for evaluating our models include the following: T- statistic, F-statistic, coefficient of determination ( $R^2$ ) and Durbin-Watson (DW) statistic.

## 2.3 Data Presentation

In this subsection, all the necessary data and analysis are presented in the table below

**TABLE 1: Yearly Time Series Regression Data**

GDP Ratio (G), Private investment in Telecommunications (PI), ICT contribution to GDP (IG), and Number of Subscribers (NS) for 1999-2009.

Year	GDP (G)** N'million	Private Investment in Telecommunications (PI)* N'million	ICT Contribution to GDP (IG)**	Number of Subscribers (NS)*
1999	312,183.5	50	195.5	N/A
2000	329,178.7	150	207.5	588374
2001	356,994.3	1,200	2,398.7	866782
2002	433,203.5	2,100	2,983.1	2271050
2003	477,533.0	4,000	3,785.5	4021495
2004	527,576.0	6,080	6,015.9	10201728
2005	561,931.4	7,500	7,851.7	19519154
2006	595,821.6	8,500	10,567.9	33603761
2007	634,251.1	11,500	14,226.8	41975275
2008	672,202.6	12,500	19,159.2	64296117
2009	716,949.7	18,500	25,812.4	74518264

**Source:** \*\*Central Bank of Nigeria Statistical Bulletin,

\*Nigerian Communications commission (<http://www.ncc.gov.ng/>)

**Notes:** Real GDP was compiled from 1981 to 2009 using 1990 constant basic prices

**Figure 1: Number of Subscribers 1999 - 2009**

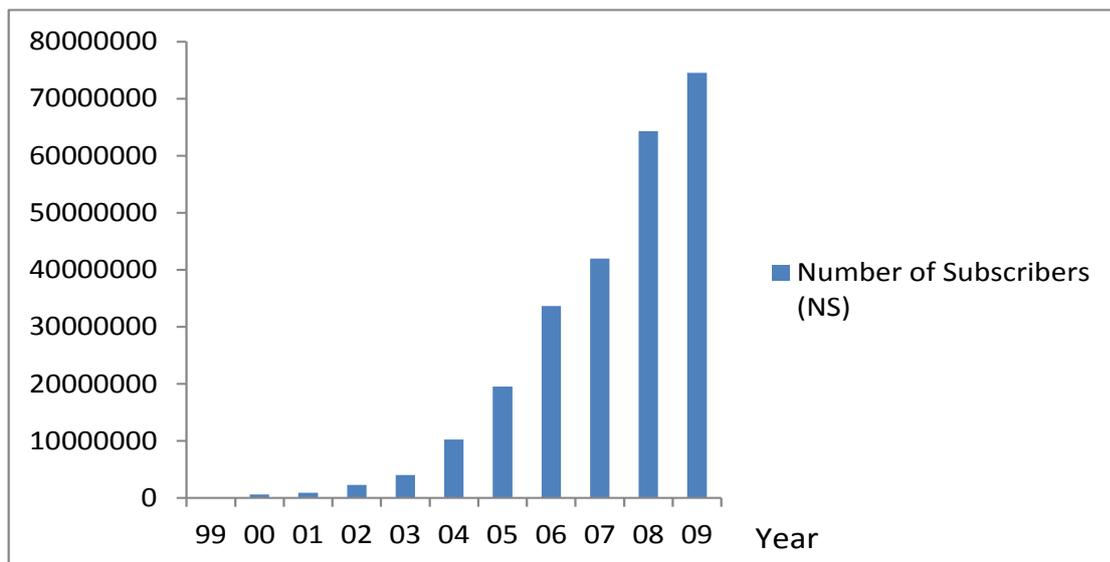


Figure 1 shows the number of subscribers from 1999 – 2009. Data for 1999 was not available, since it was the year telecommunication sector was privatized. Consequently, we have the data for 2000 – 2009. The numbers increase at a geometric rate from year 2000 – 2009 due to the telecoms liberalizations in 2001. The total number of subscribers in 2000 was 588,374 compared to 74,518,264 by December, 2009. This is staggering over 1000% increase and this showed that telephone usage penetration is one out of every 3 persons.

**Figure 2: Private Investment in Telecommunications/ICT contribution to GDP 1999 - 2009**

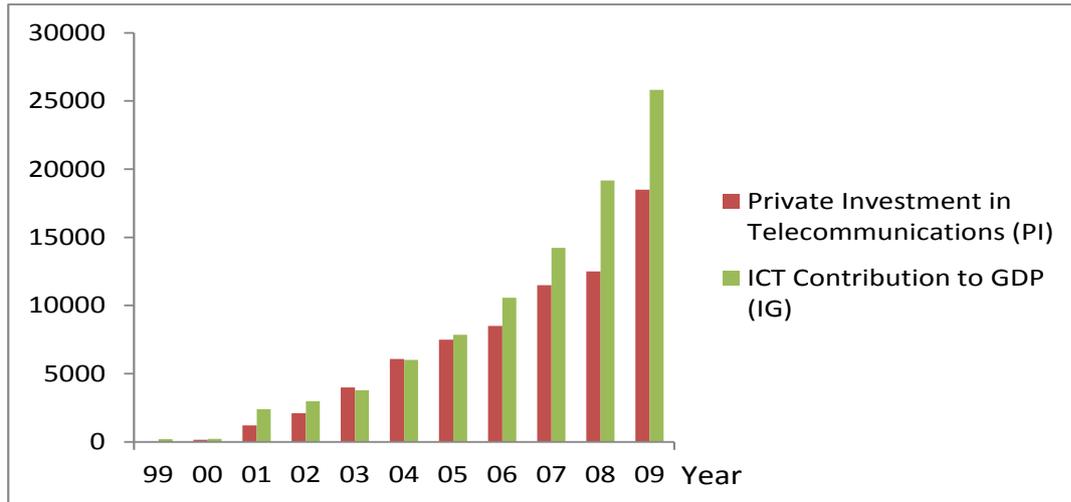


Figure 2 shows the plot of private investment in telecommunications and contribution of ICT to GDP from 1999 – 2009. In the chart as private investment increase, the contribution to GDP also increases. However, the trend was more apparent from 2001 - 2009. This shows that private investment has a major impact on the ICT contribution to GDP. Consequently, increasing the gross domestic product of Nigeria.

**Table 2: Coefficients of relationship between GDP, private investment in telecommunications, ICT contribution to GDP and number of subscribers.**

R <sup>2</sup>	Coefficient of Determination Coefficients				Sig.	Error Term E	Durbin-Watson D	F-Statistics F	T-Statistics T
	$\beta_1$	$\gamma$	$\lambda$	A					
0.952	12.626	16.101	.003	380941.08	.000	23315.125	1.638	39.750	16.339

Table 2 was derived from the extract from the SPSS used for analysing the data used.

**N/B:**

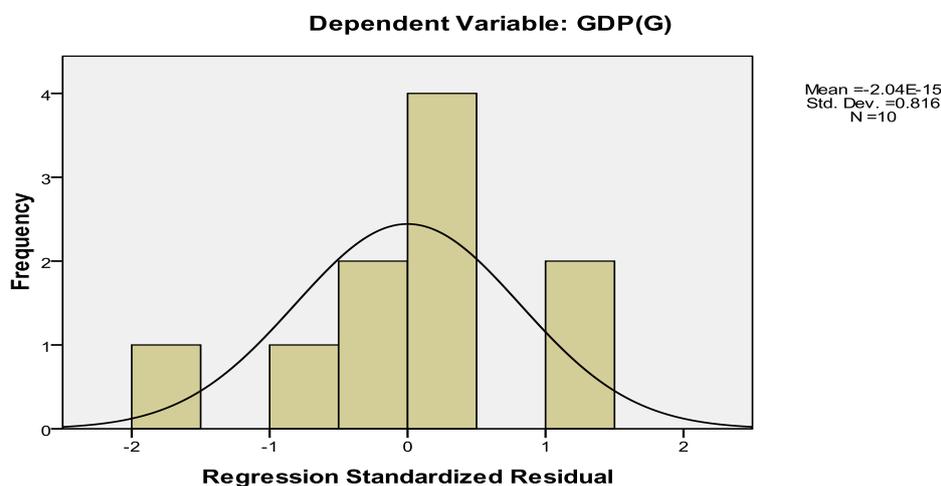
**R<sup>2</sup>** represents R square,  **$\beta_1$**  represents coefficient of private investment in telecommunications

**$\gamma$**  represents coefficient of ICT contribution to GDP,  **$\lambda$**  represents coefficient of Number of subscribers,

**$\alpha$**  represents Constant, **Sig** represents significant,  **$\epsilon$**  represents standard error,

**D** represents Durbin-Watson, **F** represents F-Statistics, **t** represents T-Statistics

**Chart 3: Regression Standardized Residual Histogram**



The histogram has a positive slope that shows a positive relationship between the variable being observed. A normal curve of one-tailed test at 0.05 level of significance is used with a mean of 2.04, standard deviation (0.816) and the population (n=11, but with no value for year 1999)

## 2.4 INTERPRETATION OF RESULTS

From the table 2 results, we can write out the regression model relating private investment in telecommunications (PI) and unemployment to gross domestic product (GDP) as,

$$G = \alpha + \beta_1PI + \gamma IG + \lambda NS + \varepsilon \dots\dots\dots(ii)$$

Equation (ii) is transformed to equation (iii)

$$G = 380941.08 + 12.626PI + 16.101IG + 0.003NS + 23315.125 \dots\dots\dots(iii)$$

$$G = 404256.21 + 12.626PI + 16.101IG + 0.003NS \dots\dots\dots(iv)$$

The model's DW statistic shows the model's predictive ability to be good. With DW statistic 1.638 close to 2, it implies that the model's has no first order auto correlation (that is model's error term is not serially auto correlated) and it implies positive serial correlation. The adjusted R-squared result shows that 95.2% of total change in GDP is accounted by private investment in telecommunications, ICT contribution to GDP and number of subscribers. The remaining 4.8% accounted for by the omitted variables. The result shows that there is a linear relationship between the variables because of their significant value to be (0.000). The result shows that there is a linear relationship between variables because its F-statistic (39.750) is greater than its probability value (0.00). Moreover, given the T-statistic (16.339) to be greater than the probability value (0.00), it means that the independent variables (PI), (IG) and (NS) are substantially and significantly contributing to the variation in the dependent variable (G). The implication is that private investment makes capital available and more accessible in the telecommunications sector which is used in acquiring resources needed and thus increases ICT total production. This consequently increases the gross domestic product and investors tend to relinquish control of their savings by committing much capital into investment in telecommunications sector because of increase in profitability. In addition, number of subscribers contributes a smaller proportion with its coefficient of 0.003. This means as number of subscriber's increases, GDP increases at 0.003 rates.

The level of significance show that the independent/explanatory variables (PI), (IG) and (NS) are contributing to the variation in the dependent variable (GDP). This is in line with the findings of Kuppusamy and Solucis (2005) and Kuppusamy and Shanmugam (2007). Their study on the impact of ICT to Malaysia over the periods 1975 – 2002 and 1983 – 2004, respectively found that ICT investment has statistically improved Malaysia's economic growth in both studies.

### 2.4.1 Private Investment in telecommunications, ICT contribution to GDP and number of subscribers

When PI is zero assuming IG and NS are constant GDP will be ₦404256.21 million. Then, if PI increases by N1million (IG and NS still constant), GDP increases by 12.626 multiple. This shows the positive relationship of PI to GDP.

Also, if IG is zero assuming PI and NS are constant GDP will be ₦404256.21million. Then, if IG increases by N1million (PI and NS still constant), GDP increases by 16.101 multiple which is the multiplier effect.

Also, if NS is zero assuming PI and IG are constant GDP will be ₦404256.21million. Then, if NS increases by N1million (PI and IG still constant), GDP increases by 0.003 multiple.

Taking the three variables at once, assuming they increase by N1million GDP increases by the multiple of 28.27 +16.101 + 0.003. However, PI contributes higher proportion than the other two variables.

## 3.0 CONCLUSION AND POLICY IMPLICATIONS

From the analysis of data, it was observed that the effect of private investment in telecommunications on economic growth in Nigeria is pronounced. Therefore, government should create the enabling environment that will make the diffusion of ICT investments maximized, due to greater ICT-enabled potential that can translate to economic growth.

Specific interventions are required if Nigeria want to use information and communications technology (ICT) tools to boost economic growth. Since, ICT increase efficiency in productivity, provide access to new markets or services, create new opportunities for income generation that can reduce poverty, improve governance, improve per capita income, reduce unemployment which are in line with the MDGs. Isolated investment in ICT will not permit this. Therefore, a more drastic development strategy will be to increase investment both from the government and the private sector to ICT.

Traditionally, a nation moves through three stages of economic development, from agriculture to manufacturing and then to services. In the current information era, it is possible to move in a parallel direction and not necessarily follow sequential development. But this would require national efforts in human capacity building. However, there are some factors militating against the smooth development of ICTs in Nigeria. These include: erratic power supply, illiteracy, cultural barriers, technological know-how, inadequate access to computers and service providers as a result of high cost of internet access. The government should therefore fine-tune its policies in view of these lapses in order to bridge any existing gaps between ICT, economy, service providers etc.

We also recommend that the government prioritise ICT access and effective use at all levels, including the provision of public access facilities, relevant content and capacity building components in all ICT activities. In particular, there should be support and investment in community public access facilities such as tele centres or local radio stations in order to ensure access for all and the creation of locally relevant content.

In conclusion, the government should provide the enabling environment, consisting of both ICT-specific regulatory frameworks and an overall policy framework that promotes sound economic and political governance. In addition, improve governance and affordability by providing a competitive framework for the application of ICT, ensuring compliance through independent regulation and favouring low-cost and open source solutions. There should be linked to national planning and strategic frameworks, including performance monitoring and dialogue processes. Finally, there should be improved ICT investment by both the government and private sector participation.

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