EMPIRICAL ANALYSIS OF TELECOMMUNICATION INFRASTRUCTURE AND ECONOMIC GROWTH IN NIGERIA

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Abstract
This study examined and assessed the effect of telecommunication infrastructure on Nigeria's economic growth, however, information Communication Technology plays a significant role in the development and sustainability of an emerging economy. As a result of globalization and changes in technology, there is a need to examine effects of Telecommunication in the development of Nigeria's economy. Thus, the study assessed the impact of Telecommunication infrastructure on Economic growth in Nigeria using secondary data between years 2000 to 2014 using Ordinary Least Square regression technique. It was establish however that Telecommunication industry is a key contributor to economy growth rate in Nigeria as its contribution to GDP increases on a yearly basis, also an agent of globalization through the services rendered by the industry over the years. This paper recommends that government should endeavor to make policies that will improve service delivery of telecommunication industry and increase its contribution to GDP (gross domestic product. Also, solutions were proffered and recommended for further studies.

Keywords: *Economic growth, Telecommunications, Gross domestic product, Globalization.*

Background to the Study

It is a well established fact that telecommunications infrastructure and services, in the age of information and transnational communication, are linchpins of a healthy, growing economy. ICT is the backbone of business activity, productivity, trade and social development (Duncombe and Heeks 1999). For a developing country like Nigeria and other West African countries, adequate telecommunication infrastructure is a precondition to the emergence of a strong market economy. The growth of industries and enhancement of social activities is dependent not only on adequate skilled labour but also effective telecommunication technology.

Telecommunication Technology has been a driving force behind organizational competitiveness in the present day business environment, since it plays significant role in almost all areas of human activities and one of the areas is economic activities. In Nigeria, policy on establishment of telecommunication infrastructure was initiated in 1999, when the civilian regime came into power of government. In addition, the licensing of different

mobile networks in Nigeria a boosted economic growth, reduce the prevalent rate of poverty in the society as it gives room for job creation and employment opportunities. The operations of the licensed telecommunication service providers in the country has created some well-felt macroeconomic effects in terms of job creation, faster delivery services, reduced transport costs, greater security and higher national output (Emmanuel and Adebayo 2011).

In Nigeria, provision of public infrastructure is grossly inadequate, as a result, necessary telecommunication services which is a public infrastructure needed as meaningful incentive to attract investors are inadequate and poor in service delivery where found and very costly which amount to a very low Teledensity in Nigeria.

Statement of the Problem

Most developing nations have embarked on various reforms that foster the use of telecommunications in their economies to aid development and gross domestic output. However, these reforms tends to yield little or minimal benefits to economic growth and development especially when compared with the developed countries in the world. It now becomes necessary to understand the existing relationship between telecommunications and economic growth in Nigeria, and the reforms that took place in the telecommunication industry to foster economic development.

Objectives of the Study

The main purpose of this research is to examine the effect of telecommunication infrastructure on the economic growth of Nigeria. Other specific objectives include to:
1. Determine the relationship that exists between Telecommunication and Nigeria's total output
2. Identify problem of Telecommunication infrastructure in Nigeria
3. Proffer solutions to improve the performance of Telecommunication industry in Nigeria.

Research Questions

The outlined research questions guided the study,
1. To what extent has Telecommunication infrastructure affect Nigeria's total output?
2. To what extent has Telecommunication setback influence economic growth in Nigeria?
3. What are the solutions that will improve Telecommunication Performance?

Research Hypothesis

H0: Telecommunication has no significant relationship with Nigeria's total output.

Literature Review

It is based on the review of literature on previous research study related to Telecommunication technology and economic growth in Nigeria. Theoretical, conceptual and empirical frame works make up this section.

Conceptual Framework

Sustainable economic development and poverty reduction of most nations usually involve the development of agriculture, mining, industrial as well as the service sectors. The use of ICT therefore enables the production of goods in a small amount of time with the assistance of computerized systems. Services are also provided more efficiently and rapidly. Growth can occur in two different ways; the increased use of land, labour, capital and entrepreneurial resources by using better technology management techniques and

increased productivity of existing resource use through rising labour and capital productivity Miles (2001); Bongo (2005). It advocates the importance of ICT in contributing to economic growth which occurs as a result of a country's use of technology. What is meant by technology is the development and application of tools, machines, materials and processes that help to solve human problems.

At the wake of 2000, the Federal Government of Nigeria embarked on an aggressive drive towards the provision of more efficient Telecommunication services in the nation through its privatization and deregulation policies. The policy led to the establishment of National Telecommunication Policy in December 2001. The policy, among other things, recognized the need for the establishment of an enabling environment for deregulation and rapid expansion of the telecommunication services in the country. The mission statement of the government was to use ICTs for Education, Creation of Wealth, Poverty Eradication, Job Creation, and Global Competitiveness. The policy objective was to develop globally competitive quality manpower in ICTs and related disciplines. This entails developing a pool of ICT engineers, scientists, technicians and software developers.

The implementation of ICTs policy led to the adoption of Global System for Mobile-Communications (GSM) and its related components in Nigeria.. In the early 1990s, only one out of every 1,000 people in Chad had a telephone and there was just ten percent chance of completing a local call, (Davari and Silva 2004). The situation is worse in Nigeria, Soludo (1998) with its teeming population. Prior to the introduction and adoption of GSM services in Nigeria, it costs about US$10 to fax one page message to America or Europe, and about US$8 to do the same task locally when the phones were functioning properly. The number of installed telephone lines was grossly inadequate to equate demand. This phenomenon was responsible for poor call completion rates, subscriber dissatisfaction, and hence, loss of revenue.

In Africa, provision of public infrastructure is grossly inadequate and poor. Necessary telecommunication services as public infrastructure needed for meaningful investment are lacking and where found are very costly. The introduction of the GSM in Nigeria was to expand the Teledensity in the country and to make telephone services cheaper and accessible since the emergence of GSM networks in 2001 which resulted in faster economic growth in the Telecommunication industry with multiple GSM providers operating nationally with line growing from 450,000 connected lines in 2001 to a mind blowing 184million lines as at September 2014. To date, at least four competitive GSM service providers have been fully licensed in the country. These Telecommunication Networks have created significant effects on the gross domestic product (GDP) of Nigeria in terms of job creation, communication linkages, connectivity, security of lives, and reduced transport costs among other. Past studies on the developing economy have bothered on the challenges and roles of ICTs on economic growth (Carayamis and Popescu 2005). Thus, this study examines the economic relevance of Telecommunication infrastructure towards sustainable development in Africa, using Nigerian economy as a case study.

Theoretical Framework
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 ICTs as an "electronic means of capturing, processing, storing, and disseminating information". These definitions directly or indirectly emphasized the impact of ICT devices on economic growth in either the short or the long run.

Early work on economic growth and development highlighted the necessity of adequate infrastructure as a basis for development. The importance of social over-head capital, which he defined as those services without which primary, secondary and tertiary production activities cannot function. The social over-head capital includes all public

services from law and order through education and public health to transportation, communications, power and water supply.

According to Belaid (2002), fewer studies focus on specific telecommunications infrastructure and their role in economic performance. The main ones concentrate on a contribution of telecommunications in reducing transaction cost, increasing TFP (Total Factor Productivity) of the private sector and diffusion of new technologies, which will remedy the problem of the developing countries.

However, to Star and Bowker (2002), infrastructure is embedded within other structures and technologies; it is transparent in use, not needing to be reinvented at each use and only becoming evident when it breaks down. Rickets (2002), viewed telecommunications as aiding the coordination of information flow, provides opportunities for increasing the efficiency of interaction and coordination, and in this manner influences the success of economic activities.

Alleman, Rappoport and Taylor (2004), asserted that a modern telecommunication infrastructure is not only essential for domestic economic growth, but also a prerequisite for participating in competitive world markets and for attracting investors. Governments and private agencies in both developed and less develop countries spend large sums of capital on infrastructure investment so as to positively influence economic activities in terms of employment, value added, productivity, capital formation and income. Furthermore, investing in telecommunication like other infrastructure investments will increase the demand for the goods and services used in their production and increase total national output. And most telecoms investment positively affects economy in three ways: First, it reduces the cost of production; secondly, it increases revenue and Third, it increases employment through both direct and indirect effects.

Domar and Solow Growth Theories
Before the growth theory proposed by Domar, there were other growth theories which thrived. Solow growth theory was one of such theories which was then in vogue. The Solow growth theory was also known as the exogenous theory because it professed technology as an exogenous factor which determines growth. One of the basic assumptions of the Solow model is the diminishing returns to labour and capital and constant returns to scale as well as competitive market equilibrium and constant savings rate. However, what is crucial about the Solow (1964) model is the fact that it explains the long run per capita growth by the rate of technological progress, which comes from outside of the model.

The endogenous growth theory or new growth theory was developed as a reaction to the flaws of the neoclassical (exogenous) growth theory. Domar endogenous growth theory was first presented in 1986 in which he take technology as an input in the production function. The theory aimed at explaining the long run growth by endogenous productivity growth or technical progress. The major assumptions of the theory are:
1.   Increasing returns to scale because of positive externalities.
2.   Human capital (knowledge, skills and training of individuals) and the production of new technologies are essential for long run growth.
3.   Private investment in Research and Development is the most important source of technological progress
4.   Knowledge or technical advances are non-rival good.

Empirical Review
Several empirical studies have been conducted on the impact of telecommunication infrastructure investment on economic growth. However, while much have been written about the experiences of developed countries on the linkages between ICT and economic growth, there have been few corresponding studies from developing countries especially those in Africa whose economies are vulnerable to disruption associated with gross

inadequacy in infrastructural facilities and corruption. There is a clear evidence in literature that telecommunication infrastructure serves as a primary sources of economic development. Roller and Wavernman (2001) found a statistically positive relationship between economic growth and telecommunication infrastructures investment. A study of Yilmaz, et al (2001) indicated that the accumulation of telecommunication infrastructure improves the overall productive capacity at the regional level by examining the impact of telecommunication infrastructure on economic output both at the aggregate and sectoral levels in the United States.

Canning (1999) in his study takes a broader perspective, evaluating the contribution of investment in various kinds of infrastructure to the aggregate output of the economy. He found that telephones have a larger impact on aggregate output than other kinds of infrastructure. While power generation and transportation infrastructure produce approximately the same productivity effect of other capital investment, the productivity effect of telephone infrastructure is surprisingly higher in comparison. According to Canning (1999), this suggests that telecommunications infrastructure generates larger spillover to other sectors of the economy.

Exploring another branch of the empirical literature, some empirical studies attempted to use a transaction-cost approach to evaluate the relationship between ICT expansion and economic growth. In a cross-sectional study, Hulten and Schwas (1991) conclude that expansion of telephone infrastructure provides "substantial growth and investment-enhancing activity and thus facilitates economic development. Norton's explanation for this finding is grounded in the argument that access to telecommunications reduces transaction cost. However, his study does not rule out other possible explanations for the positive impact of telecommunications on economic growth.

Research Methodology
The data for this study is basically time series data which are quantitative in nature. They are mainly secondary data sourced from Central Bank of Nigeria statistical bulletin, national bureau of statistics, National Communications Commission (NCC) and other relevant journals. The data include: Gross Domestic Product, and communications covering the period of 2000-2014. The methods of analysis or estimation techniques include Ordinary Least Square (OLS) method, Durbin Watson statistics. This is backed by a priori economic theory and relevant time series data which span a period of 15 years

Model Specification
The functional form of the model is given thus:
$LogRGDP = f(LogTELCOM)$……………………………………… (1)
In stochastic form equation (1) becomes:
$LogRGDP = \beta_0 + \beta_1 LogTELCOM + e$……………………………………… (2)
Where: RGDP = Real Gross domestic Product

       TELCOM = TeleCommunication
e   = Error term

Regression Results

STATISTICS	VALUE
Multiple R	0.994
Multiple R²	0.988
Adjusted R²	0.987
F(1,13)	1042.785
P	0.000
Standard error of estimate	0.014
Durbin Watson	1.132852
Serial correlation	0.351863

Table 1.1

	Beta	Std Err of Beta	B	Std Err of B	t(13)	P-Level
Intercept			2.550153	0.008674	294.0083	0.0000
Logcom	0.993824		0.221559	0.006861	32.2922	0.0000

Table 1.2

LOGRGDP = 2.5502+0.2216TELCOM
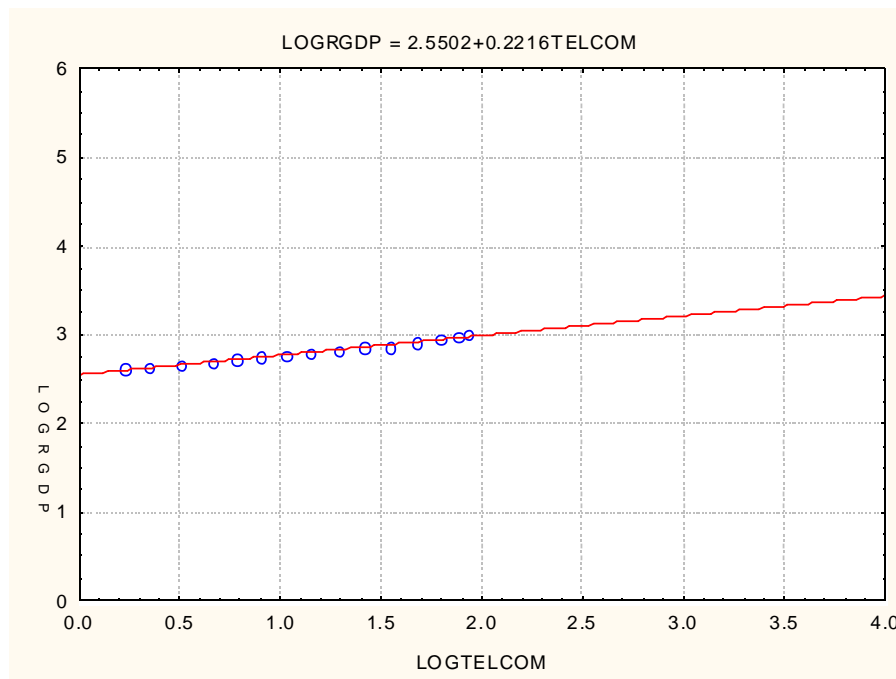
Data Analysis and Interpretation of Results
The regression equation for the model is given as LOGRGDP=2.5502+0.2216LOGTELCOM.
From the result above, the coefficient of LOGCOM is 0.2216 which shows that a 1% increase in communications will on the average cause 0.22% increase in the gross domestic product. Finally, the economy grows at the rate 2.6% when all the explanatory variables are equal to zero. The R^2 and adjusted R^2 for this model are 0.988 and 0.987 respectively However, the Durbin-Watson stat of 1.13285 which shows the presence of serial autocorrelation in the dependent and independent variables.

In the above analysis it can be deduce that the independent variable that is,

communication explains 98% of the dependent variable which is the real GDP while the remaining 2% was explained by the error term. Thus, the model overall goodness fit yields a better result as it tends to move towards one ($0<R^2>1$). Also the adjusted R^2 shows that there is a good degree of freedom with the data used for analyzing the model (Table1.1)

The observed F-ratio value from the analysis is greater than the critical F-ratio of 5% level of significance hence; the overall independent variables are significant and belong to the model used. Also the standard error of estimate is relatively smaller than the required 10% or 0.1 for acceptability of the result of the model which is 0.014 (Table1.1)
The Durbin Watson test is a test for serial or auto correlation in a given model. The model has no correlation problem and can be completely relied upon as there is correlation among the data used in the model (Table1.1).

In addition, a scattered diagram in Figure 1.1 shows that the model line produces line of best fit, thus making the model a reliable model for estimation with 0.95 prediction level.

Findings and Conclusion
It was established that information communication technology has a positive contribution towards Nigeria economic growth that is, an increase in ICT development will lead to increase in the Nation's economic growth, and a key contributor to Gross domestic product value in Nigeria. It leads to more jobs been created for citizens through the expansion of Telecommunication by navigating into the global world of computer age and electronic media. Improve welfare in the country through good standard of living and increase in per capita income, reduce cost of living and increase in productivity level in all sectors in the economy due to the large global Telecommunication network which helps government keep up with the latest trends in World of globalization.

Recommendations
The following recommendations were established
1.   Government should establish rules and regulations on technical norms guiding firms in telecommunication industry and other industries to boost productivity.
2.   Provide adequate infrastructure across the country for the development of Telecommunications firms so as to expand communication sector in local government.
3.   Regulate more often the price charge by telecommunication firms so as to encourage more usage by the populace and make life comfortable for them.

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APPENDIX

YEARS	RGDP(BILLIONS)	TELCOM(BILLIONS)	LOGRGDP	LOGTELCOM
2000	412.3	1.7	2.615213	0.230449
2001	431.8	2.2	2.635283	0.342423
2002	451.8	3.2	2.654946	0.50515
2003	495.0	4.6	2.694605	0.662758
2004	527.6	6.0	2.722305	0.778151
2005	561.9	7.9	2.749659	0.897627
2006	595.8	10.6	2.7751	1.025306
2007	634.3	14.2	2.802295	1.152288
2008	672.2	19.2	2.827499	1.283301
2009	719.0	25.8	2.856729	1.41162
2010	716.3	34.8	2.855095	1.541579
2011	834.0	47.0	2.921166	1.672098
2012	888.9	62.0	2.948853	1.792392
2013	950.7	77.0	2.978043	1.886491
2014	1016.9	85.6	3.007278	1.932474