

Technology

Information and Communication Technologies in the Nigerian Economy

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Most developing nations have embarked on various reforms that foster the use of ICTs in their economies. These reforms tend to yield little or minimal benefits to economic growth and development, especially when compared with the developed countries of the world. Technological advancement is known to impact fast rate of economic development. In Nigeria, policy on adoption of Information and Communication Technologies was initiated in 1999, when the civilian regime came into power of government. 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.

This study intends to investigate the emerging roles of ICTs on Nigerian economy, and to evaluate the factors that influence the decisions of investors in the Nigerian telecommunications sector.

Ordinary Least Square Method of Regression for the period 1999 – 2004, shall be employed. This period is considered appropriate in that, it was the time that policy on ICTs was adopted. The paucity of data prior to this time also poses restriction on meaningful econometric analysis.

Significant and positive relationship between ICTs and economic growth is expected as it is portrayed in some economic literature.

While telecommunication service providers receive commensurate profit on their investment efforts, the regulation from the government should ensure competitiveness. This strategy will increase the quality of the services offered, and possibly at cheaper price.

Introduction

Attempts to ensure sustainable economic development and poverty reduction of most nations usually involve the development of agriculture, mining, industrial as well as the service sectors. The Industrial Revolutions in Europe and America, generally and specifically, have been premised on 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). Similar trend has been observed with the economic development of China, Korea, Taiwan, India, South Africa, and other emerging economic powers (Mafe, 2000).

At the wake of 2000, the Federal Government of Nigeria embarked on an aggressive drive towards the provision of more efficient services in the nation through its privatisation and deregulation policies. The policy thrives led to the establishment of National Telecommunication Policy in December 2001. The policy, among other things, recognised 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. Consequently, attractive career opportunities will emerge in addition to development of *Made in Nigeria* softwares and computer components that can earn the nation some foreign exchange. The implementation of ICTs policy led to the adoption of Global System for Mobile-Communications (GSM) and its related components in Nigeria.

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. Teledensity in Africa and Nigeria, in particular, is very low. 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 (Easterly 1996). 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.

The introduction of the GSM in Nigeria was to expand the teledensity in the country and to make telephone services cheaper and accessible to the common person as it had been introduced in some African countries like South Africa, Ghana, and Benin Republic among others. To date, at least four competitive GSM service providers have been fully licensed in the country. These are Mobile Telephone Networks Limited (MTN), V-Mobile Nigeria (V-go), Globacom Nigeria Limited (glo), and Nigerian Mobile Telecommunications (Mtel). 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 Nigerian economy have bothered on the challenges and roles of ICTs (Ndukwe, 2003, 2004; Igwe, 2005). Thus, this paper, specifically, investigates the emerging growth effects of ICTs on Nigerian economy particularly since the introduction of GSM services, and evaluates the factors that influence the decisions of investors in the Nigerian telecommunications sector. The paper has three other sections. Relevant literature on

telecommunication and theoretical basis are reviewed in section two. Section three presents the methodology, analysis, and interpretation of the results. Section four concludes the study.

Review of Literature and Theoretical Analysis

The Conceptual and Theoretical Framework

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 et al (1999) simplify the definition by describing ICTs as an “electronic means of capturing, processing, storing, and disseminating information”.

Theoretically, two Schools of Thought explain the relationship between telecommunications and development. These are the *Technophilic* and the *Technophobic* views. The Technophiles believe that ICTs impact positive effects on development. This perspective argues that in the various communities and sectors of the economy, ICTs will expand productivity, improve employment opportunities, and upgrade the quality of work in many occupations. Moreover, ICT will offer many opportunities for small-scale, independent, and decentralised forms of production. Regarding developing countries, technophiles envision that technology will aid developing countries to leapfrog stages of development (Castells 1999; Mansell & Wehn 1998; Nulens & Van Audenhove 1998).

On the other hand, the technophobes regard ICTs as having negative effects on development and widening the information gap between the rich and the poor, the literate and the illiterate. While admitting that ICTs could have profound changes on a society, Van Dijk (1999) believes that applications of ICTs and their transformative nature have been greatly exaggerated. ICTs may destroy more jobs than they create; the gap between the rich and the poor may widen. Mansell (1999) saw the huge capital investments required on ICTs as diverting resources from other sectors of the economy that could have greater development impacts. On economic level, this perspective forecasts a perpetuation of the capitalist mode of production, with further managerial control over the means of production. In most countries, it foresees massive job displacement and ‘de-skilling’.

Empirical Review

Many economists have observed a positive correlation between the level of telecommunications use and some indices of economic well being. Jipp (1963) studied the relationship between the income of a nation and telephone density, using data for different countries, and found a positive correlation between the two. Bebee, et al (1967) also studied the relationship between telephone facilities, their uses, and economic performance using data from 29 countries at different stages of development. They constructed three indices: a telephone index representing the availability of telephone facilities and their uses, an

economic performance index, and a development support index representing other supporting factors needed in economic development. The analysis shows a strong positive correlation between the telephone index and the economic performance index. It explains the role of supporting factors in enhancing the contribution of telecommunications to economic development. Hardy (1980) and Moss (1981) found a strong positive correlation between telephone facilities and economic development at the macro level. Conversely, absence of modern technology is a major obstacle to growth and poverty reduction. These assertions are the general conclusion of two conferences jointly organised by the Telecommunication Development Bureau of the International Telecommunication Union and the International Relations Program of Webster University in Geneva, in September 1996 and February 1998 under the title “Telecommunications and Economic Growth” (Abutaleb, et al, 2001)

Nandi, and Dholakia, (1994) established a relationship between investments in telephone infrastructure and economic development. They examined the connection among a number of factors such as education, energy, telephones, other physical infrastructures and economic development. The results of the multiple regressions adopted in the analysis suggest that simultaneous investment in development inputs such as education; telecommunications and other physical infrastructures are complementary in the promotion of economic growth. Saunders, et al (1994) conducted several studies examining the correlation between the density of telephone lines and economic development. Madden, et al (1998), also, examined the empirical relationship among gross fixed investment, telecommunication infrastructure investment, and economic growth for a sample of transitional countries of Central and Eastern Europe. The results of the studies show a positive relationship between investment in telecommunications and national economic growth. Empirical evidences show that investment in ICTs enhances efficiency of economic activities, and that economic growth stimulates the demand for telecommunications and other ICTs’ components.

The impact of telecommunications on growth was first found by Hardy (1980) based on data from 45 countries, with the greatest effect of telecommunication investment on GDP found in the least developed economies, and the smallest effect, in the most-developed economies. Garbade, et al (1978), observed strong statistical support for the hypothesis that the two innovations in communication technology (the Telegraph and Trans-Atlantic Cable) led to efficient market worldwide through significant and rapid narrowing on inter-market price differentials. Leff, (1984) argued that firms can have more physically dispersed activities with increased telecom services, and, thereby, enjoy economies of scale.

Sridhar and Sridhar (2000) found strong correlation, based on several regressions and instrumental variable methods, between investment and productivity growth in developing countries, which imply that developing economies have to import and install machinery and equipment, in order to grow. Using the Peterson Index, Cronin, et al (2002) shows how basic telecommunication infrastructure can create a “digital provide” by making markets more efficient through information dissemination to isolated and information-deprived localities, and improve the living standards of the poor, which in turn accelerate growth.

According to Balimoune (2002), the global economy has been driven by a greater integration of world markets and a spectacular growth of ICTs. Country data reveal a global digital divide. It is feared that the so-called New Economy will reinforce the gap between rich and poor nations, and increase income and spatial inequalities within countries. There is a growing body of literature focusing mainly on the effects of the New Economy on industrial countries. The empirical evidence indicates that ICTs diffusion has a significant positive impact, in varying degrees, on GDP growth (Oliner and Sichel 2000; Pohjola 2001; and Jalava and Pohjola 2002).

Braga (1998) built a case that concludes that the countries with greater prospects of economic performance in the New Economy are those that can rely on widespread access to

communication networks; the existence of an educated labour-force and consumers; and the availability of institutions that promote knowledge creation and dissemination. This may suggest that developing countries are at a disadvantage in comparison to developed countries. Similar sentiments are shared by Mansell & Wehn (1998). Brown (2001) argued that ICTs are simply tools. He maintained that no single tool can solve a global problem, such as, poverty and its attendant socio-economic problems, which have such complex and multiple causes. He stressed the role of educated labour-force in this information age.

Chowdhury (2000) noted that many sceptics 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. According to Bayes, et al (1999), only half of all telephone calls are related to economic purposes such as discussing employment opportunities, prices of the commodities, land transactions, and that, the average prices of agricultural commodities were higher in villages with phones than in villages without phones. The New Economy may offer a new channel for economic growth that may allow developing countries to catch the development train faster, and perhaps ensure a more sustainable ride.

The Nigerian ICTs Experience

Following the release of a new telecommunication policy in year 2001, several Private Telephone Operators, Fixed Wireless Access Operators, Internet Service Providers, and a Second National Carrier have begun operation in Nigeria (Ndukwe, 2003). The activities have increased and promoted competition in the industry, resulting in exponential growth in the number of telephone lines. Within the first six months after the take-off of the GSM in Nigeria, more than 350,000 mobile lines were activated. The existing operational fixed lines rose from 450,000 in December, 2000 to 888,854 by March, 2004. At this time, mobile lines increased to 3.8 million (Akwani, 2005)

Recognising the seemingly insatiable appetite of consumers for phone services, and the potentials of the Nigerian market, investors pumped in US\$2.110 billion into the sector by December 2002, US\$2.55 billion by June 2003, and over US\$4.0 billion by March 2004. The initial investment was just US\$50 million as at the end of 1999. This represents a percentage increase of over 8,000. 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. The Network Providers in Nigeria has been devoting huge sums of money to support sports. e-voting is in the pipeline, with strong support from major stake holders, against the on-coming national election in 2007. It is expected that the Network Providers will soon devote their assistance towards research in the higher institutions of learning in Nigeria. The impacts of ICTs have been noted to influence the environment, employment, poverty alleviation, attraction of foreign funds, 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. The teledensity (fixed and mobile lines) in Nigeria has jumped from 1 line to 440 persons in 1985

to 1 line for every 263 persons in 1997 and 1 to 18 in 2004. As at March, 2004, the sector created about 5,000 new direct jobs and 400,000 indirect new jobs. These appear in the form of the various ICT engineers, scientists, technicians, software developers, accountants, managers and clerks employed by the network operators, and individual small scale related activities. Table 1 shows a picture of how the introduction of ICTs has been able to generate employment at the grass-root. The average monthly profit from Table 1 is commensurate in the process of alleviating poverty since the Nigerian per capita income is about US\$320 - implying below US\$1.00 per day – and US\$1.00 exchanges for about ₦140.00

Table 1: Grass-root Employment Capacity of ICTs

Business Line	MTN		glo		V-go	
	Range/day	Avg/month	Range/day	Avg/month	Range/day	Avg/month
Cost (₦)	1400-5600	3135	450-1840	1055	950-4930	2269
Revenue (₦)	1860-7500	4105	570-2880	1537	1350-6750	3164
Profit (₦)	380-1900	971	110-1040	482	350-1820	895
Profit/Cost		31.0%		45.7%		39.4%

Source: Culled from Akinsanya, (2004)

Methodology, Analysis, and Interpretation

Data Source and Analytical Technique

The data required for this study are of secondary source. The data relate to the aspects of ICTs and economic development such as investment in the telecommunication sector, gross domestic product, population density, and number of computer users. These data are sourced from the publications of the Central Bank of Nigeria (CBN), and World Bank. This study adopts ordinary least square (OLS) analysis to examine the effects of ICTs on economic development of Nigeria.

The Model

This study adopts a model that is similar to that of Alleman, et al. (2004), and Bezmen, et al (2003). Both the introduction and application of ICTs influence the performance of any economy. As found in most studies, economic performance is evaluated with data on Gross Domestic Product (GDP). Accordingly, $LogGDP = \alpha_0 + \alpha_1 LogICTs + \mu$

(1)

Several variables are viewed as components of ICTs, but this study adopts

$$LogICTs = \varpi_0 + \varpi_1 LogTel.Inv + \mu \quad (2)$$

Substituting equation (2) into equation (1) gives

$$LogGDP = \delta_0 + \delta_1 LogTel.Inv + \mu \quad (3)$$

This study further considers investment in telecommunication sector to be influenced by population density and number of computer users. Thus,

$$Tel.Inv = \lambda_0 + \lambda_1 Dens + \lambda_2 Comps + \mu \quad (4)$$

The whole structure of ICTs, in Nigeria, is taken to include investment in the telecommunication sector (Tel.Inv), the number of personal computers (Comps), the population per square kilometre (Dens). Equations (3) and (4) are regressed. Equation (3) measures the role of investment in the telecommunications sector on economic growth. Equation (4) considers the main factors influencing investment in the telecommunications sector, and thus, economic growth in Nigeria. Investment in the telecommunication sector is a necessary component of ICTs. Acquisition of personal computers will facilitate computer

literacy, and internet usage. High population density, as found in urban centres and cities well-populated by students, creates more pressure on the supply and demand of ICTs facilities. The δ s and λ s in equations (3) and (4) are the parameters to be estimated while μ is the zero-mean stochastic error variable, which also controls the other variables that influence GDP. It is expected that increased investment in the telecommunication sector will cause GDP to rise ($\delta_1 > 0$). Similarly, positive impacts are expected through population density ($\lambda_1 > 0$) and number of personal computers ($\lambda_2 > 0$).

Analysis of Data and Interpretation

The data for the period 1999-2004 were employed for the models. 1999 was the year of new democratisation in Nigeria and the consequent adoption of ICTs policy reforms. The results of equation (3) shown in Table 2 indicate that all the coefficients are statistically significant at the one percent level. The Durbin-Watson statistic also has a value that is close to 2.0. The Adjusted R-square is 0.766 and by implication, about 77 percent variation in GDP during 1999 – 2004 is attributable to investment in telecommunication.

All the parameters, λ s, in equation (4) are statistically significant. The value of Durbin-Watson statistic does not indicate serious autocorrelation problem in the model and the F-statistic is significant. By the Adjusted R-square, the explanatory variables of population density and number of personal computers account for 97 percent of the factors influencing investment in the telecommunication sector. Population density explains consumer demands for the services of ICTs. Computer usage, too, implies literacy and internet usage (Bezmen & Depken, 2003).

The Normality test on equation (4) is based on the following:

H₀: Residual errors are normally distributed

H₁: Residual errors are not normally distributed

The result shows that the residuals are normally distributed and bell-shaped. The Jarque-Bera statistic is 0.74 with the p-value of 0.69 while theoretical $\chi^2_{2,0.05}$ is 5.99. Since 0.74 is less than 5.99, the null hypothesis cannot be rejected. This conclusion conforms to the bell-shape of the histogram that indicates normal distribution.

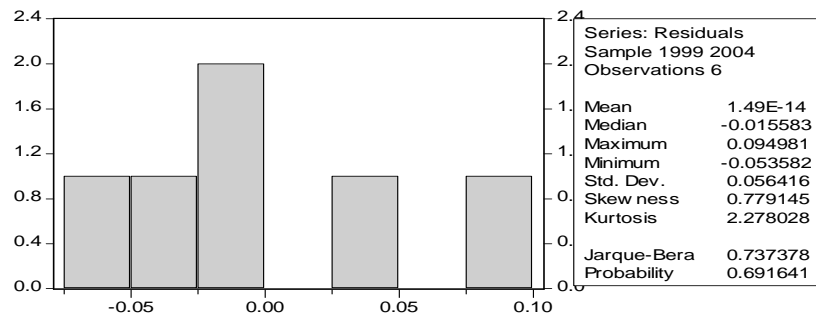
Table 2: Results on Equations (3) and (4)

	Equation 3	Equation 4
	Dep var: Log(gdp)	Dep Var: Log(Tellinv)
C	11.176 (10.862)*	28.787 (63.992)*
Log(Tel.Inv)	0.550 (4.171)*	
Log(DENSITY)		17.667 (4.284)*
Log(COMPS)		0.150 (2.675)**
R-squared	0.813	0.984
Adj R-squared	0.766	0.973
F-stat	17.397	92.548
Prob(F-stat)	0.004	0.002
D-W stat	1.958	2.103

*Significant at the 1% level; **Significant at the 5% level; t-statistics are in parentheses.

Source: Researcher's Compilation, (2006)

Figure 1: Normality Test on Equation (4)



Source: Output of Regression Results, (2006)

Conclusion

ICTs can aid sustainable economic development when used appropriately, with the full participation of all stakeholders, especially the developing economies. The intrinsic value of ICTs lies not in easing communications and information, but in enabling growth and development. In a country like Nigeria, where a vast section of the population is below the poverty line, ICTs offer a chance to empower the residents and transform them into more productive human capital.

Traditionally, a nation moves through three stages of economic development, from agriculture to manufacturing and then to services. However, 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.

There are some factors, however, militating against the smooth development of ICTs in Nigeria. These include erratic power supply, illiteracy, cultural barriers, lack of computer skills and technological know-how, inadequate access to computers and computer networks as a result of the digital divide, and 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 the economy and the rest of the world.

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