Aggregate Analysis of the Impacts of Telecommunication Infrastructural Development on Nigerian Economy

Gold Kafilah Lola

Department of Economics
Kwara State College of Education Ilorin-Nigeria

Abstract *The world has become a global village with communication being an indispensable tool in the entire globalization process. The roles of Telecommunications and Information Technology (IT) have become highly essential in this process. In Nigeria, development in this vital sector has been very phenomenal and the usage of Telecommunication (GSM) has become very prominent with noticeable effect on several economic aspects. It is however instructive to investigate the effects of this latest technology on communication on the Nigerian Economy. The study examined the effects of telecommunication infrastructural development on the Nigerian economy and examined the growth implication. Secondary data was used for the study. Data collected was analyzed with econometrics technique, in the econometrics technique used, model was specified and Ordinary Least Square method (OLS) was used in estimating it. However, the findings revealed that telecoms have influenced the economy by increasing their market access and reduced distribution cost, which invariably affected the service provider cost. Also, the study revealed how GSM has enabled Nigerians to transact their businesses easily resulting in higher productivity; reduction in poverty level and prevalence through increase in income generating capacity and business expansion; improved living standard; boosted economic capacity, and stimulate the economy to achieve the desired macroeconomic policy targets.*

Keywords: Tele-density, Telecommunication and Gross Domestic Product (GDP)

Introduction

The world has become a global village with telecommunication being an indispensable tool in the entire process of globalization. However, it is not in dispute that Telecommunications and Information technology (IT) play essential roles in this process. This is obviously why development in this vital sector over the years has been phenomenal all over the world. In fact, this is why emerging trends in socio - economic growth shows high premium being placed on Information and Communication Technology (ICT), by nations, organizations and homes. Nigeria, fortunately, has not been left out of this race for rapid development in the telecom industry. Unlike in the past, governments consider telecommunications service to be so vital to national interest and economic development that it was placed directly under their control in most countries until fairly recently, when deregulation and competition were introduced (Lee, 2003). These recent advances in telecommunications technology have been an important vehicle in permitting information exchange to develop as a valuable commodity for moving the country into post industrial and information based economic growth. In this present world, a modern telecommunication infrastructural development is not only essential for domestic economic growth, but is a prerequisite for participation in increasingly competitive world markets and for attracting new investments.

Given this development, the perspective on telecommunications development research today should concentrate on how best to increase and include telecommunication as an essential component of the economic development. Telecommunication infrastructural development should indeed be seen as an indispensable precedent in economic development. According to World Bank (1995), late starters in the telecommunications, "will risk exclusion from the global economy and face severe comparative disadvantage on their goods and services". The development of telecoms in the world began in the 1830s. According to Ajayi, Salawu and Raji (2008), Sir Charles Wheatstone constructed the first commercial electrical telegraphy and Sir William Forthergill CookeSamuel Morse on the other side of the Atlantic Ocean independently developed another version of electrical telegraphy that he unsuccessfully demonstrated on 2nd September 1837. Soon, after Alfred Vail developed the register and was successfully demonstrated on 6th January,

1938. The first transatlantic telegraphy label allowing transatlantic telecommunication for the first time was successfully completed on 27th July, 1866. Alexander Bell invented the conventional telephone in 1876 and the first commercial telephone services were set-up in 1878 and 1879 in both Haven and London (ITU, 1999). Further development of telecoms in the world was prompted by the need to provide seamless telecommunications throughout Europe. In the early 1980s, analogue mobile telephony grew rapidly and operators found it increasingly difficult to interconnect the various networks in Europe. On the basis of this, a study group called "Group Special Mobile" was formed and was tasked to provide a standardized system for mobile telephony, which was realized seven years later.

However, Nigeria today has not been left out of this race for rapid development, after years of gross under-development; the nation's telecom was liberated with the return of democracy in 1999 and the deregulation of the telecoms sector. This led to the granting of Global System for Mobile Telecommunication (GSM) licences by the Nigerian Communication Commission (NCC) to three providers like Econet, MTN, and M-tel. This was followed by the licensing of the Second National Operator (SNO), in 2003; that is, Globalcom and Universal Access Service licenses of 2006 which include fixed telephony, VSAT and internet service providers. Also, in March 2008, the NCC gave license to another GSM operator known as Etisalat (Aigbinode, 2008).

The recognition that telecommunications development is an important input in a household or a nation's production function has major implication for development policy. In Nigeria, given the long years of decadence, the factors responsible for the slow growth in telecoms sector in spite of the encouragement and enormous investment by the government before the deregulation in the 1990's were not looked into. In addition, the fact that the trend and the revolution of the development of telecommunication (GSM) growth on Nigerian Economy have not received a great deal of attention from researchers prompted this study and it is against this background that this study has been conceived and inspired.

Literature Review

Early work on economic growth and development highlighted the necessity of adequate infrastructure as a basis for development. Hirschman (1958) recognized 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. 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. Economic activities require significant levels of interaction and coordination in order for them to be conducted successfully and efficiently. 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 increasingly competitive world markets and for attracting new investments. 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 ;
- Second, it increases revenue and
- Third, it increases employment through both direct and indirect effects.

Vuong (2008), reported how mobile phones promotes economic growth through an example of Fishermen in the South of Indian by communicating through mobile phones, they were able to sell their fish in markets where the demand was high. This resulted in less waste of fish, higher benefits and lower cost of doing business, more access to information, which leads to more efficient operations which in the end affect the economic growth. Also, Roller and Waverman (2001) and Waverman, Meshi and Fuss (2005), in their studies on telecoms, opined that telecoms infrastructure can lead to economic growth through many different ways. Firstly, according to them, investing in the telecom sector itself leads to growth; Secondly, increased demand in telecom related goods and services e.g. producing cables, machines, extra workloads etc. contributes to growth. More importantly, as telephone technology improves, people communicated more regularly over bigger distances.

According to Rodini, Ward, and Woroch (2003), Telecommunications has impact on Human and Social capital through history, theory and growth in the developing world in Development Economies. In recent years, there have been a large number of telephone demand studies that emphasized the substitution or complementary between fixed and mobile telephone services. While some of these studies find substitution between mobile phones and fixed phones systems using consumer phone data. Vagliasindi, Guney and Taubman (2006); Minges (1999); Madden and Coble-Neal (1999); and Okada and Hatta (1999), found out that mobile phones and fixed phones are moderate substitutes and that the lower the penetration rates of fixed phones, the stronger the substitutability between fixed and mobile phones. This may be similar to the African situation (including Nigeria) since telephone penetration rates are low in Africa compared to other parts of the world. It is therefore, interesting to note that telecoms infrastructure has strong positive effects on economic growth, especially for a developing country like Nigeria.

Theoretical Framework

This study examined the impacts of telecommunication development on Nigerian economy under the framework of the theory developed by Mankiw, Romer, and Weil (1992). However, since the prevalent usage of GSM is likely to improve living standard of users. Theoretically, the aggregate improvement will translate into economic growth. Figure 1.1 illustrates how telecommunication improvement brings about growth through productivity gain.

Figure 1: Input driven and GSM-productivity- driven income growth curve
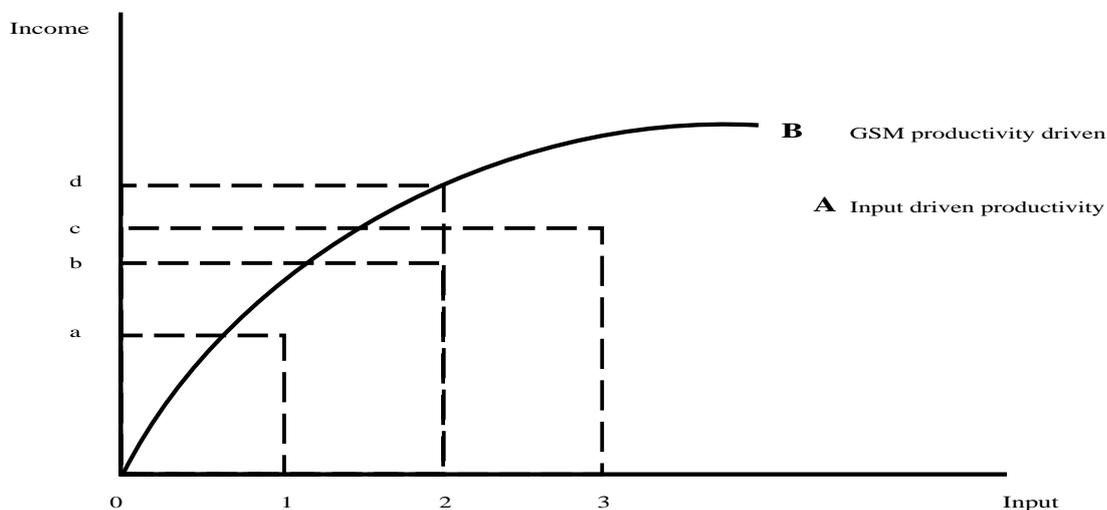
When input (income, human capital and labour) is increased from 1 to 2 units, income increased from a to b. with additional inputs, the income is increased, but at a decline rate from b to c. This is because it is subject to decreasing returns. A movement along individual productivity function A reflects the income growth gained from additional inputs. Income growth through improvement in productivity can be derived from the application of improved technological innovations (such as usage of GSM). This can cause the productivity to rise upward from A to B, and without any additional inputs, the output will grow from b to d, which comes only from improvement in productivity (production –driven income growth). Another source of productivity growth is savings in transaction cost that result from the usage of GSM. This is made possible through what can be termed 'mobile—command' which covers all financial and commercial transaction that take place through the use of GSM. In addition, GSM generates economic growth through generation of direct and indirect employment. The direct employment include those that work in service provider companies, those that deal in retail and whole sale trading of recharge cards, handsets, batteries, chargers, etc. it also include those that provide repairs and engineering services.

Methodology

Ordinary Least Square (OLS) method was used to estimate the parameters of the model. The normality assumption on the error term in regression model suggests OLS as the best-unbiased estimator (Gujarati, 1995). This was because the OLS estimator of σ^2 is $\sum \hat{U}i^2/(n-k)$ where n and k are the total numbers of observations and estimated parameters takes into account the number of degree of freedom. The aim of the regression analysis was to obtain and test for significance of the parameters in the model. This aim can best be achieved using OLS method, which yields unbiased, consistent and efficient estimates. Such result lends itself to easy and clear interpretation.

The Growth Model

The growth model is specified mathematically as;
GDP = F (TELED, LGSM)   …………(1)
This can be expressed in a linear form as:
GDP = Φ_0 + Φ_1 TELED + Φ_2 LGSM   …………(2)
If we include the error term, equation (2) can be rewritten as
GDP = Φ_0 + Φ_0 + Φ_1 TELED + Φ_2 LGSM + U_i ………….(3)
Where   GDP = Gross Domestic Product
            TELED = GSM Tele-density
            LGSM = GSM connected lines
            Φ_0 = constant Factor
            $\Phi_1…,\Phi_n$ = slopes of the variables for estimation.
        U_i = Error term
On theoretical ground, (*a priori*) we expect the parameters to take positive signs i.e. Φ_1, Φ_2, >0. This mean there should be positive relationship between GDP growth rate, GSM Tele-density and GSM connected lines.

Discussions of the Results

The model postulate that the level of economy depends on the volume of GSM services rendered and telephone density. The data period is from 2001 to 2008 (Appendix, Table 2.1). This was the most appropriate period as GSM started effective in Nigeria in 2001, while data on 2009 is still unavailable. The result of the regression as reported in Table 1.1 showed that both the GSM connected lines (GSM) and Tele-density (TELED) have significant impacts on Gross Domestic Product (GDP). For instance, GSM variable is

positive with 0.165 and 7.07 as coefficient and t-value respectively. It implies that an increase in number of GSM connected lines may translate to about 1.7% increase in GDP. As the GSM connected lines increases, it will result in greater employment and income generation. It would also result in lower cost of doing business as cost on travelling as well as transaction cost will reduce.

These reductions in cost boost investment and promote more production of goods and services. It also resulted to increase in productivity and efficiency. With respect to the tele-density, as expected, the sign is negative but significant. Higher density implies that the higher number of people has no access to telephone. As the density reduces the telephone lines per 1000 person reduces and more people have access to telephone. Therefore, Nigerians are able to transact and promote their business easily, resulting in higher productivity and increase in standard of living.

Table 1.1: Regression results on Effect of GSM on the Growth of Nigerian Economy

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	10.55028	0.339110	31.11165	0.0000
LGSM	0.165212	0.023346	7.076657	0.0009
TELED	-0.004021	0.002822	-1.425070	0.2135
R-squared	0.985432	Mean dependent variable		13.16703
Adjusted R-squared	0.979604	S.D. dependent variable		0.211796
S.E. of regression	0.030247	Akaike info criterion		-3.878829
Sum squared residual	0.004574	Schwarz criterion		-3.849038
Log likelihood	18.51531	F-statistic		169.1061
Durbin-Watson stat	1.536237	Probability (F-statistic)		0.000026

Source: Data analysis, 2010.

The result of the regression as reported in the table above shows that both the GSM connected lines (GSM) and Tele-density (TELED) are significant and affect gross domestic product (GDP) positively.

I   The Coefficient of The Multiple Determination R^2: The coefficient of the multiple determination stood at 0.979604 (i.e. 97%). This means that the explanatory variables: GSM Tele-density and GSM connected lines accounted for 97 percent of the total changes in the dependent variable (GDP). This shows that the regression result is a good fit.

II The Standard Error: The value of the standard error for the entire variables in the model shows that the parameter estimate were statistically significant. These values were less than half of the values of the coefficient of the variables.

III Durbin–Watson Statistics: The test for the presence of autocorrelation was performed by making use of the Durbin Watson statistics. The Durbin Watson statistics is 1.5. This was found to be within the normal region which falls within the determined region (i.e. $1.5 < d < 4$) and imply that there is negative first order serial autocorrelation among the explanatory variables.

IV The GSM lines variable was correctly and positively signed. It was also statistically significant. The expected outcome of this coefficient is a positive one. The implication of this result is that, if GSM lines increases in the long-run, all other things being equal, the economy will grow. It shows that a percent rise in GSM lines will cause as much as 17 percent growth in the gross domestic product. This result indicated that GSM lines have the greater influence on the growth of Nigerian economy. From economic point of view, if GSM lines increases, it would reduce the cost of business such as cost on mobility and travelling as well as transaction cost. This reduction in cost would boost investment and promote more production of goods and services.

V With respect to the Tele-density, contrary to expectation, the sign is negative but significant. Higher density implies that; the higher the number of people who has access to telephone as the density

reduces, the telephone lines per 1000 person reduces and fewer people will have access to telephone. The implication of these results is that Tele-density is still very low to permit an overall increase in output growth in Nigeria.

Summary of Findings

(i) The Nigerian economy is predicted to have naturally gained from emerging into information technology age. Meanwhile, a licensing process universally adjudges to have been rare display of transparency, openness and non – intervention, has turned the fortunes of the country around, and consequently raises investor's confidence in the Nigerian market and economy.

(ii) Thus, the outcome of the empirical and stochastic investigations shows that Telecommunication Infrastructural Development has a positive relationship with output growth in Nigeria. The impact is of a higher magnitude. The introduction of Global System for Mobile telecommunication (GSM) led to 17 percent rise in the output growth.

(iii) In addition, it was discovered that if the Tele-density should increase to a considerable level in Nigeria, there would be industrial and technological transformation and the growth and development of Nigeria economy would be sustained.

Conclusion

The Nigerian economy is predicted to have naturally gained from emerging into information technology age, with a licensing process universally adjudges to have been rare display of transparency, openness and non – intervention, has turned the fortunes of the country around, and consequently raises investor's confidence in the Nigerian Telecoms market and economy. Likewise, Telecommunication has also increased employment generation, reduced transportation costs, increased business efficiency, attracts foreign funds, and a host of other benefits.

Recommendations

From the findings and conclusions presented above, recommendations were made to the management of the regulatory body of mobile Telecommunication in Nigeria; that is, the Nigerian Communication Commission, the GSM operators in Nigeria (both public and private) and the Federal Government of Nigeria. The government should expand tele-density and directly make telephone communications cheap and accessible. To achieve this goal, more licenses should be given to GSM operators in order to allow for healthy competition among the GSM operators.

In addition, the NCC should ensure that the interests of the consumer of telecommunication services are protected by promoting competitive pricing of such services and combating the abuse of market power. Since the success of a very effective telecommunication requires a very efficient and honest administration on the part of the government and on the part of the GSM operators, the NCC should also ensure that consumers are given value for their money, and misleading adverts by the Nigerian
GSM operators should be stop as this does not conform to international practices.

APPENDIX

Table 2.1 Telecoms Subscriber Information (Year 2001 – March, 2008)

	2001	2002	2003	2004	2005	2006	2007	Jan 08	Feb. 08	Mar 08
Mobile (GSM)	266,461	1,569,050	3,149,472	9,174,209	18,295,896	32,184,861	54,413,784	56,492,255	57,720,782	57,622 ,901
Mobile (CDMA)	N/A	N/A	N/A	N/A	N/A	N/A	824,741	621,604	702,146	780,938
Fixed Wired/wireless	600,321	702,000	872,473	1,027,519	1,223, 58	1,673,161	2,449,019	2,454,443	2,417,705	2,537,504
Total	866,782	2,271,05	4,021,945	10,201,728	19,519,154	33,858,022	57, 87,544	59,568,302	60,840,633	60,941,348
Mobile (GSM)	N/A	N/A	N/A	N/A	N/A	N/A	40,011,296	41,049,103	42,483,091	43,786,542
Mobile (CDMA)	N/A	N/A	N/A	N/A	N/A	N/A	384,315	413,198	424,325,	567,185
Fixed wired/wireless	N/A	N/A	N/A	N/A	N/A	N/A	1,579,664	1,453,566	1,430,616	1,545,984
Total	N/A	N/A	N/A	N/A	N/A	N/A	41,975,275	42,915,867	44,338,032	45,899,711
Mobile (GSM)	N/A	N/A	N/A	N/A	N/A	N/A	76,545,308	77,545,308	77,545,308	79,625,308
Mobile (CDMA)	N/A	N/A	N/A	N/A	N/A	N/A	1,540,000	1,520,000	3,720,000	3,170,000
Fixed wired/wireless	N/A	N/A	N/A	N/A	N/A	N/A	6,578,303	5,633,251	5,576,481	5,676,481
Total	N/A	N/A	N/A	N/A	N/A	N/A	84,663,611	84,698,559	86,841,789	88,471,789
[1]Teledensity	0.73	1.89	3.35	8.50	16.27	24. 18	29.98	30.65	31.67	32.79

Source: Tell, 2008.

[1]Teledensity was calculated based on population estimate of 126 million people up till December 2005: from December 2006, Teledensity was based on a population of 140 million.
[2]Teledensity from December 2007 was based on active subscriber

References

Aigbinode, R. (2008, July 7). Seven years of telecoms revolution – the breathtaking   revolution in telecoms industry. *Tell Magazine of Nigeria*, pp. 25-28.

Ajayi, G.O., R.I. Salawu, Raji, T.I. (2008). A century of telecommunications development in nigeria—What next?. Retrieved from http//file://F:\telecom\nigeria.htm.

Alleman, J., C. Hunt, D. Michaels, P. Rapport, L. Taylor (2004). Telecommunications and economic development: Empirical evidence from southern Africa. *International Telecommunications Society*, Sydney. Retrieved from *http://www.colorado.edu/engineering/alleman/print_files/soafrica_paper. pdf.*

Belaid, Hend (2002). Telecommunication infrastructural and economic development, simultaneous approach: Case of developing countries. *ERMES, Research Team on Markets, Employment and Simulation*, Paris II University, Pantheon-Assas.

Gujarati, D.N. (1995). *Basic econometrics*. New York: McGraw-Hill, Inc., pp. 838.

International Telecommunications Union (1999). *Trade in telecommunications: Second world telecommunications policy forum Report held in Geneva.* Retrieved from http://www.itu.int/net/home/index.aspx.

Lee, K.W.M. (2003). Private partnership in telecommunications export development: The canada west telecom group. *The British Columbia trade and Investment Office, Canada.*

Madden, G., G. Coble-Neal (2004). Economic determinants of global mobile telephony growth. *Information Economics and Policy.* No.16, pp. 519-534.

Mankiw, N.G., D. Romer, D.N.W. (1992). A contribution to the empirics of growth. *Quarterly Journal of Economics.* Volume 107, No. 2, pp. 407-37.

Mazango, Eric (1998). *Telecommunications sector reform: Liberalisation and universal service policy in zimbabwe* (Doctoral dissertation). Available from IMK University, Oslo theses database.

Minges, M. (1999). Mobile cellular communications in the southern african region. *Telecommunications Policy*. Volume 23, pp. 585-593.

Okada, Y., K. Hatta (1999). The interdependent telecommunications demand and efficient price structure. *Journal of the Japanese and International Economics*, No13, pp. 311-335.

Ricketts, M. (2002). *The economics of business enterprise.* UK: Cheltenham: Edward Elgar.

Rodini, M., M. Ward, G. Woroch (2003). Going mobile: Substitutability between fixed and mobile access. *Telecommunications Policy*, No. 27, pp. 457-476.

Roeller, L.H., Leonard Waverman (2001). Telecommunications infrastructure and economic development: A simultaneous approach.

The American Economic Review, vol. 91, no 4, September, pp.909-23.

Star, S., G. Bowker (2001). How to develop infrastructure. In L.A. Lievrouw, & S. Livingstone (Eds.), *The Handbook of New Media*. London: Thousand Oaks, New Delhi.

Vagliasindi, M., I. Guney, C. Taubman (2006). Fixed and mobile competition in transition economies. *Telecommunications Policy*, No. 30, pp.349-367.

Vuong, Victor (2008). *Mobile telecommunication impact on developing countries growth (*Bachelor thesis in international economics and finance). Available at Tilburg University Theses database.

Waverman, L., Meloria Meshi, Melvyn Fuss (2005). The impact of telecoms on economic growth in developing countries. *Vodafone Policy paper series,* No. 2, pp. 10-24.

World Bank (1995). Harnessing information for development: World bank group vision and strategy. *World Bank / International Bank for Reconstruction and Development*, Washington DC: Retrieved on September 12, 2008 from http://www.worldbank.org