International Journal of Business, Economics and Management
2014 Vol. 1, No.2, pp. 16-28
ISSN(e): 2312-0916
ISSN(p): 2312-5772

HOW TELECOMMUNICATION DEVELOPMENT AIDS ECONOMIC GROWTH: EVIDENCE FROM ITU ICT DEVELOPMENT INDEX (IDI) TOP FIVE COUNTRIES FOR AFRICAN REGION

Ani Wilson[1] --- Ugwunta David[2] --- Eneje Beatrice[3] --- Okwo Mary[4]

[1]*Lecturer in the Banking and Finance Department, Michael Okpara University of Agriculture*

[2]*Lecturer in the Banking and Finance Department, Rennaisance University, Enugu*

[3]*Lecturer in the Accountancy Department, Institute of Management and Technology, Enugu*

[4]*Lecturer in the Accountancy Department, Enugu state University of Technology, Enugu*

ABSTRACT

This study examines the effect of telecommunication development on economic growth in five leading ICT developed countries for African region. Following previous studies, teledensity (or the penetration rate) is defined as the number of fixed-lines and mobile phone subscribers per 100 persons as a proxy to measure the development of the telecommunications sector, while economic growth is proxied by Gross domestic product at current prices (US dollars). After ensuring data stationarity, the Granger causality test shows no causal relationship between mobile and fixed teledensity and economic growth. In spite of this, the OLS test clearly shows that telecommunication development in Africa has a positive and significant influence on economic growth.

Keywords: Telecommunications, Teledensity, Foreign direct investment, Economic growth Gross domestic product, stationarity, Fixed lines, Mobile lines.

Jel Codes: D61, O19, 031

1. INTRODUCTION

A modern telecommunication infrastructure is not only important for domestic growth but also critical for connecting the domestic market of commodities as well as credit with international commodity and financial markets. This facilitates the smooth flow of foreign investment, positive value of net exports; increase the value addition in GDP of an economy etc. Recent developments in telecommunication technology have been seen as an important tool for making information available to develop a sharp and valuable commodity market. The 21st century is characterized by endeavours made by countries and sectors to equip themselves with the necessary telecommunication system. The telecommunication sector around the world has been undergoing dramatic reforms since1980's. Developed countries started to sustain their development in telecommunication in that era; on the other hand developing countries also

started to develop their telecommunication infrastructure after realizing its importance in economic development. This effort has resulted in privatization of state-owned firms and telecommunication sector reforms.

After year 2000, the realization about the importance of telecom sector for economic growth has increased especially in developing countries. Countries struggled to advance their telecommunication infrastructure in different ways. It is a fact that this sector increased the economic contribution of foreign sector within the countries, telecom impact on economy can be decomposed into direct and indirect effect. The direct impact of telecommunication leads to attract Foreign Direct Investment (FDI) that generates different opportunities at sectoral level such as high earning job opportunities, the increase in demand for technical labor, transfer of technical capabilities on locals, increased trade etc. In the same token, the liberalization expanded the market and consumers had a greater choice to purchase. Not only service providers but the mobile phones and wireless companies also established a competitive equipment market and introduced advanced technology as well. On the other hand the indirect employment with the establishment of call centers, customer service centers and cellular phone franchises increased, and a highly competitive labor market also established, secondly telecommunication development also generated the business activities as well, firms now connected to each other very easily and the international market also on the finger-tips of businessmen through internet. Telecommunications remains a hub for development of any economy. Telecommunication is an essential infrastructural component that enhances the growth of other sectors; agriculture, education, industry, health, banking, defence, transportation and tourism. It is indispensable in everyday activity that promotes economic growth. A functional and efficient telecommunications service is indispensable for any country to join the globalized League of Nations.

This study focuses on how telecommunication development increases economic growth in leading ITU ICT Development index for Africa. It is a panel study that estimates how the increase in fixed telephone lines and mobile phone teledensity (users per 100 people) affect economic growth as Africa is having an emerging telecom market.

2. REVIEW OF RELATED LITERATURE

The link between telecommunication and economic growth has been studied widely by researchers in recent years seeking to connect the nexus between telecommunication and economic growth. For instance Ricketts (2002) opines among other things that telecommunications aid coordination of information flow, provide opportunities for increasing the efficiency of interaction and coordination, and in this manner influence 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 *et al.* (2004) on the other hand 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. Generally, telecommunication and it's ancillaries contribute to economic growth through: Increasing productivity across all sectors; facilitating market expansion beyond borders to harvest economies of scale; lowering costs of and facilitating access to services, notably in administration, education, health and banking; providing access to research; development of ICT products and services; contributing to better governance, a prerequisite to growth, through increased participation, accountability and transparency.

The use of telecommunication services provides positive externalities, enhancing creativity, learning and problem-solving skills. Its impact in the short-run can be felt on employment while in the long-run, it is the interaction among connectivity, access, network security, capability/skills, market structures and firm governance, as well as the regulatory and facilitation environment, certainly determines whether firms from developing countries can participate effectively and efficiently in the information economy and compete in global e-marketplaces.

Studies of telecommunications development on economic growth in the developed economies reported positive relationships between telecommunications and economic growth (Jipp, 1963; Hardy, 1980; Moss, 1981; Saunders *et al*., 1994; Lichtenberg, 1995; Greenstein and Spiller, 1996). However, not many studies have been carried out in this topic in the sub-saharan Africa. Also, the studies investigated the relationship between telecommunications and economic growth without considering its impact on economic growth, and the direction of causality between telecommunications development and economic growth. Although telecommunications development has been found to be one of the factors that affect economic growth, its contribution has varied between countries at different stages of development. Additionally, studies indicate that the contribution of telecommunications to economic growth is not independent of the level of telecommunications development see (Roller and Waverman, 1996; Karner and Onyeji, 2007).

For instance, Karner and Onyeji (2007) examine the contribution to economic growth of private telecommunications investment in 14 African countries and 13 countries in Central and Eastern Europe (CEE) for the period 1999 to 2005. Their regression results indicate that the contribution is positive but insignificant. They argue that this may be due to the relatively low level of telecommunications infrastructure in the selected countries, which diminishes the effectiveness of private investment in telecommunications.

In another dimension, Roller and Waverman (1996) examined the impact of investment in telecommunications infrastructure on the GDP of 21 OECD countries and 14 developing or newly-industrialized non-OECD countries between1970 and 1990 and find that the impact may not be linear: it is greater in OECD countries than it is in non-OECD countries and in countries that have reached "critical mass", that is, the number of main telephone lines exceeds 40 per 100 persons.

Similarly, Sridhar and Sridhar (2004) investigate the relationship between telecommunications and economic growth using data from 28 developing countries. The study finds that there is a positive impact of fixed lines and a significant impact of mobile phone

penetration on national output. The impact of telecommunications penetration on total output is found to be significantly higher for developing countries than for OECD countries. This agrees with the outcome of a study by Waverman *et al.* (2005) who found that mobile telephony has a positive and significant impact on economic growth.

Going further, Cronin *et al.* (1993b) attempted to determine the causal relationship between telecommunications and economic growth. The study revealed a bidirectional relationship between telecommunications infrastructure and economic growth in the United States. A causality analysis carried out by Madden and Savage (1998) also confirms a bidirectional relationship between telecommunications investment and economic growth in CEE countries. Chakraborty and Nandi (2003) study indicated a bidirectional relationship between teledensity and GDP in both the short run and the long run in 12developing countries in Asia. When these countries are divided into two groups with a high and low degree of privatization, respectively, the causality is bidirectional only for those countries in the former group. Cieslika and Kaniewsk (2004) confirms a positive and statistically significant causal relationship between telecommunications infrastructure and income at the regional level in Poland and finds that the causality runs from the former to the latter. Yoo and Kwak (2004) found a bidirectional relationship between information technologies investment and economic growth in South Korea over the period 1965-1998. A more recent study carried out by Wolde-Rufael (2007) also finds a bidirectional relationship between the two in the United States over the period 1947-1996.

However, Shiu and Lam (2008) found a unidirectional relationship from GDP to telecommunications development in China. Causality in the opposite direction, that is, from telecommunications to economic growth, is found only in the affluent eastern region, but not in the low-income central and western provinces.

According to Qiang (2009) in a recent World Bank analysis to test the impact of telecommunications penetration on economic growth rates at country-level of 120 countries shows that for every 10% point increase in the penetration of mobile phones, there is an increase in economic growth of 0.81% points in developing countries, *versus* 0.60 percentage points in developed countries. The study also found that all information and communications technologies promote growth more effectively in developing countries than in developed ones. This is because telecommunications services help improve the functioning of the both the public and private sectors. These issues were more acute in developing economies than in developed ones. Therefore, developing countries gain more by resolving some of them through better access to telecommunications (Qiang, 2009). What is clear from these studies is that little effort ha been made in previous studies to connect how telecommunication growth leads to economic growth in key economies in the African region. This is one of the main motivations of the paper.

3. DATA AND METHODOLOGY

Data about telecommunications development and economic growth were gathered for the 2010 top five African countries ITU ICT Development Index (IDI). Since we are writing from Nigeria, Nigerian country data has been included bringing the sample size to six countries in Africa.

Table-1. ITU ICT Development Index (IDI): 2010 Top Five per Region

Regional IDI Rank	Europe	IDI Rank	Asia & Pacific	IDI Rank	Americas	IDI Rank	Arab States	IDI Rank	CIS	IDI Rank	Africa	IDI Rank
1	Sweden	2	Korea (Rep.)	1	United States	17	UAE	32	Russia	47	Mauritius	69
2	Iceland	3	Hong Kong, China	6	Canada	26	Qatar	44	Belarus	52	Seychelles	71
3	Denmark	4	New Zealand	12	Barbados	41	Bahrain	45	Moldova	57	South Africa	97
4	Finland	5	Japan	13	Uruguay	54	Saudi Arabia	46	Ukraine	62	Cape Verde	104
5	Luxembourg	7	Australia	14	Chile	55	Oman	60	Kazakhstan	68	Botswana	109

Source: ITU Statistics http://www.itu.int/ict/statistics.

Following previous studies (Chakraborty and Nandi, 2003) we use teledensity (or the penetration rate) as a proxy to measure the development of the telecommunication sector in our study. Teledensity is defined as the number of fixed-line and mobile phone subscribers per 100 persons. We used the number of fixed-line and mobile subscribers to measure teledensity as mobile communications are taking the stage in the selected African countries. In view of the explosive growth of mobile communications in the past decade, we believe that including the number of mobile phone subscribers in our definition of teledensity is a better proxy to reflect telecommunications development in Africa. Economic growth is proxied by Gross domestic product at current prices (US dollars). Values are based upon GDP in national currency converted to U.S. dollars using market exchange rates (yearly average) (IMF, 2012). The data used in this study are taken from the databases of the International Telecommunications Union (ITU) and the IMF World Economic Outlook, which have allowed us to construct a complete dataset of GDP and telecommunications statistics for six countries from 2000 to 2011.

3.1. Econometric Model

The analyses were carried out in stages. First, we ascertained the properties of our variables to ensure that there is no unit root problem using the ADF unit root test. A time series is considered to be stationary if its mean and variance are independent of time. If the time series is non-stationary, that is, having a mean and or variance changing over time, it is said to have a unit root (Johannes *et al.*, 2011). Stationarity is important in econometrics as most time series data exhibit unit root problem. If a time series is non-stationary, the regression analysis carried out in

a conventional way will produce spurious results. A non-stationary time series can be converted into a stationary time series by differencing (Johannes *et al*., 2011). Secondly, we ascertained the causality relationship between economic growth and telecommunication teledensities via Granger causality test. Thirdly, we ascertained the relationship between economic growth and teledensity as well as the magnitude of teledensity on GDP via OLS.

Our model followed a dynamic panel data model for examining the causal relationship between telecommunications development and economic growth is as follows.

$$GDPit = \alpha a \, \Sigma MTELit + c \quad \ldots\ldots (1)$$

$$MTELit = \alpha a \, \Sigma GDPit + c \quad \ldots\ldots (2)$$

$$GDPit = \alpha a \, \Sigma FTELit + c \quad \ldots\ldots (3)$$

$$FTELit = \alpha a \, \Sigma GDPit + c \quad \ldots\ldots (4)$$

$$GDP = f(MTELit + FTELit) + c + u \quad \ldots\ldots (5)$$

GDP, MTEL and FTEL refer to logged real GDP and logged mobile teledensity and fixed teledensity respectively, the paper represents the countries in the sample, and t represents the time periods.

3.2. Discussion of Findings

Telecommunication infrastructure in Africa has increased over the past years, in spite of the challenges of low population density, low in-comes and large rural populations especially with the mobile telecommunication. Particularly noteworthy is the virtual explosion of mobile phones in sampled African countries (Botswana, Cape Verde, Mauritius, Nigeria Seychelles and South Africa) which surpassed 163 million subscribers as at the end 2011 and continues to grow. This has been particularly beneficial for rural areas and more pronounced. It is estimated that there are around 400,000 localities in Sub-Saharan Africa, of which 99% are villages.

According to the ITU table above, it is obvious that the Nigerian market has proved to be the fastest growing mobile-cellular telephone market in Africa with about 30,000 subscribers in year 2000 to over 95 million subscribers as at the end of 2011 with over 3000% subscriber increment. South Africa as at year 2000 had about 8,339,000 subscribers which have increased to 64,000,000 as at end of 2011.

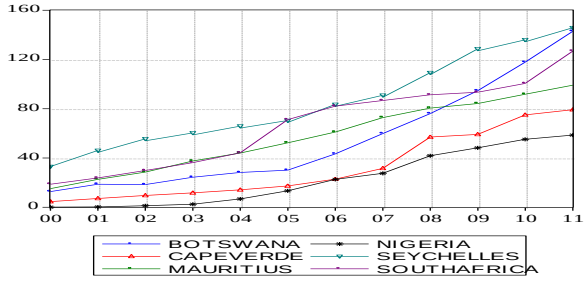
Table-2. Mobile-cellular telephone subscriptions for our Sample

	Botswana	Mauritius	Nigeria	Cape Verde	Seychelles	South Africa	Total
2000	222,190	180,000	30,000	19,729	25,961	8,339,000	8,816,880
2001	332,264	272,416	266,461	31,507	36,683	10,787,000	11,726,331
2002	332,264	347,532	1,569,050	42,949	44,731	13,702,000	16,038,526
2003	444,978	462,405	3,149,473	53,342	49,229	16,860,000	21,019,427
2004	522,840	547,745	9,147,209	65,780	54,369	20,839,000	31,176,943
2005	563,782	656,828	18,587,000	81,721	58,806	33,959,958	53,908,095
2006	823,070	772,395	32,322,202	108,858	70,340	39,662,000	73,758,865
2007	1,151,761	928,622	40,395,611	152,212	77,278	42,300,000	85,005,484
2008	1,485,791	1,033,300	62,988,492	277,670	93,476	45,000,000	110,878,729
2009	1,874,101	1,086,748	74,518,264	290,621	110,668	46,436,000	124,316,402
2010	2,363,411	1,190,900	87,297,789	371,871	117,587	50,372,000	141,713,558
2011	2,900,263	1,294,100	95,167,308	396,429	126,594	64,000,000	163,884,694

Source: ITU Statistics http://www.itu.int/ict/statistics.

Notwithstanding the above increases in the Nigerian mobile-cellular telephone subscriber base it was unable to make the top five African countries ITU ICT Development Index (IDI): 2010 top five per region. The mobile teledensity of Nigeria is far below that of the ITU ICT Development Index (IDI): 2010 top five per region for Africa as depicted below.

Fig-1. Graphical Representation of Mobile Cellular Subscriptions per 100 Inhabitants



Source: Authors' Graphic.

The graphical representation above shows that all the ITU ICT Development Index (IDI): 2010 top five Africa and Nigeria recorded a steady increase in teledensity with Seychelles and Botswana just a little below 150 percentage points as at 2011.

Table-3. Mobile Cellular Subscriptions per 100 inhabitants

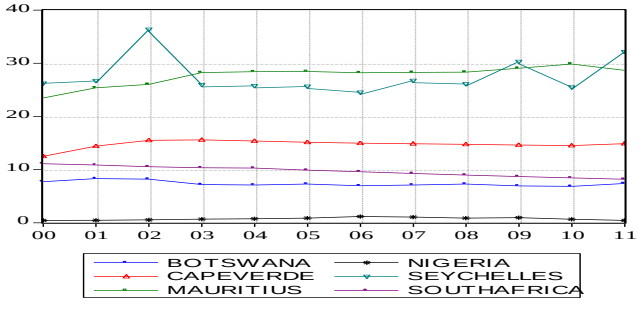
Years	Botswana	Cape Verde	Mauritius	Nigeria	Seychelles	South Africa
2000	12.64	4.51	15.05	0.002	32.99	18.63
2001	18.62	7.08	22.55	0.21	46.06	23.77
2002	18.38	9.49	28.47	1.21	55.47	29.78
2003	24.31	11.6	37.48	2.37	60.29	36.16
2004	28.23	14.09	43.97	6.71	65.8	44.13
2005	30.06	17.28	52.26	13.29	70.42	71.06
2006	43.3	22.76	60.98	22.55	83.45	82.06
2007	59.75	31.51	72.8	27.49	90.94	86.6
2008	76.01	56.97	80.48	41.81	109.24	91.24
2009	94.58	59.11	84.14	48.24	128.57	93.34
2010	117.76	74.97	91.67	55.1	135.91	100.48
2011	142.82	79.19	99.04	58.58	145.71	126.83

Source: ITU Statistics http://www.itu.int/ict/statistics.

The table and graph above shows that as at 2011, Seychelles recorded the highest mobile teledensity of 145.71% followed by Botswana at 142.82%, South Africa at 126.83% and Nigeria closing the trend at 58.58%.With the rapid development of wireless broad band, mobile communications are evolving from simple voice communication services and text messaging to a more sophisticated offering with a wide range of applications in locations where conventional services are not available. "Smart" wireless phones, for example, now allow users to also browse the Internet, download music, and access information services (Qiang, 2009).

While the mobile telecommunication teledensity has enjoyed a steady growth in the last decade for the sampled countries, the fixed telephone teledensity has been on the decline, stagnated for the different countries in our sample as depicted below.

Fig-2. Fixed Telephone subscription per 100 inhabitants.



Source: Authors' Graphic.

Table-4. Fixed Telephone Subscription per 100 Inhabitants.

	Botswana	Cape Verde	Mauritius	Nigeria	Seychelles	South Africa
2000	7.73	12.5	23.48	0.45	26.21	11.09
2001	8.3	14.41	25.39	0.47	26.68	10.85
2002	8.19	15.5	26.03	0.54	36.35	10.53
2003	7.18	15.59	28.23	0.67	25.95	10.34
2004	7.11	15.36	28.4	0.75	25.74	10.27
2005	7.28	15.14	28.45	0.87	25.63	9.89
2006	6.95	14.97	28.21	1.18	24.53	9.6
2007	7.1	14.86	28.28	1.07	26.74	9.28
2008	7.28	14.74	28.32	0.87	26.09	8.97
2009	6.93	14.62	29.05	0.96	30.3	8.68
2010	6.85	14.51	29.84	0.66	25.48	8.43
2011	7.37	14.88	28.67	0.44	32.13	8.18

Source: ITU Statistics http://www.itu.int/ict/statistics.

The graph and table above reveals that as 2011, Seychelles have the highest fixed telephone teledensity of 32.13% followed by Mauritius at 28.67%. Cape Verde recorded 14.88 while South Africa recorded 8.18%. Seychelles teledensity for the decade had variations in growth dropping from 36.35% 2002 to 24.53% in 2006 and rising to 30.3% in 2009. Notwithstanding the liberation of telecommunication in Nigeria in 2000, the fixed telephone teledensity hit an all-time high of 1.18% in 2006 but have been on the decline afterwards closing the decade at 0.44%. Overall, the mobile-cellular teledensity is way above the fixed telephone teledensity.

3.3. Unit Root Test Result

To guard against spurious regression result, the individual properties of the time series were ascertained via the ADF unit root test. The result is presented below.

Table-5. Augmented Dickey Fuller Unit Root Test.

Variables	**1% Critical value*@ level**	**ADF Test statistic @ level**	**Status**	**1% Critical value* @**	**ADF Test Statistic (t*)**
nlGDP	-4.0948	-2.151358	1st difference	-4.0969	-4.586271
nlMobile	-4.0948	-3.439008	1st difference	-4.0969	-5.872018
nlFixed	-4.0948	-2.431751	1st difference	-4.0969	-4.986592

Source: Author's E-view 3.1 output.

The above table reports that none of the time series were stationary at level as their ADF test statistic at level are all > the 1% critical value at level indicating a unit root. Applying differencing, the non-stationary time series were converted into stationary time series at1stdifference.ADF statistics of -4.586271, -5.872018 and -4.986592 form l GDP, nlMobile teledensity and nlFixed teledensity respectively < -4.0969 1% critical value. Subsequently, we

conclude that there is no unit root with the time series; that, the time series are stationary for further statistical tests.

Table-6. Pair wise Granger Causality Tests\

Date: 10/14/12 Time: 10:46			
Sample: 1 72			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
DNLFIXED does not Granger Cause DNLGDP	70	0.45417	0.50268
DNLGDP does not Granger Cause DNLFIXED		0.13335	0.71613
DNLMOBILE does not Granger Cause DNLGDP	70	0.04933	0.82491
DNLGDP does not Granger Cause DNLMOBILE		0.01201	0.91306
DNLMOBILE does not Granger Cause DNLFIXED	70	0.07721	0.78197
DNLFIXED does not Granger Cause DNLMOBILE		0.73080	0.39567

Source: Authors' Eviews3.1Output

The Granger causality of our variables suggests no causality. We accept the null hypotheses as represented below and conclude a Non-directional causality among the variables.

DNLFIXED does not Granger Cause DNLGDP	Accept
DNLGDP does not Granger Cause DNLFIXED	Accept
DNLMOBILE does not Granger Cause DNLGDP	Accept
DNLGDP does not Granger Cause DNLMOBILE	Accept
DNLMOBILE does not Granger Cause DNLFIXED	Accept
DNLFIXED does not Granger Cause DNLMOBILE	Accept

The above result is strengthened with the probability of the F-statistics been > 0.05 significance level among GDP, teledensity mobile and teledensity fixed for our sample. Our findings does not conform to the findings of Cronin *et al.* (1993b) and Madden and Savage (1998) that found a bidirectional relationship between GDP and teledensity. However, in line with the findings in developed economies that telecommunications development has positive relationships with economic growth, our findings suggest that telecommunication development have positive relationship with economic growth. See table 7.

The regression result presented above reveals that not only do telecommunication development has a positive relationship with economic growth it also has a significant impact on economic growth. Given that the t-Statistics of 10.67 and 4.899 > t* 2, we confirm a statistical significant impact of telecommunication development captured as teledensity on GDP (economic growth). The result is further strengthened by the p-value of 0.0000 < p* 0.05. Our adjusted coefficient of multiple determinations Adj. $R^2$of 0.618 suggests that 61.8% of the variations in our dependent variable GDP are caused by the independent variable teledensity.

Table-7. Ordinary Least Squares Result.

Dependent Variable: DNLGDP				
Method: Least Squares				
Date: 10/14/12 Time: 10:51				
Sample(adjusted): 2 72				
Included observations: 71 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DNLFIXED	-1.362025	0.127630	-10.67171	0.0000
DNLMOBILE	0.293291	0.059860	4.899651	0.0000
C	0.022721	0.033151	0.685380	0.4954
R-squared	0.629079	Mean dependent var		0.026387
Adjusted R-squared	0.618170	S.D. dependent var		0.451918
S.E. of regression	0.279251	Akaike info criterion		0.327925
Sum squared resid	5.302723	Schwarz criterion		0.423531
Log likelihood	-8.641326	F-statistic		57.66383
Durbin-Watson stat	1.871586	Prob(F-statistic)		0.000000

Source: Authors' Eviews3.1

Our study findings are in line with the findings of studies of telecommunication development in developed economies. Such studies include the World Bank studies as well as the studies of (Jipp, 1963; Hardy, 1980; Moss, 1981; Saunders *et al*., 1994; Lichtenberg, 1995; Greenstein and Spiller, 1996).

Wireless and fixed telecommunications are therefore a service of general economic interest. It enhances the knowledge, skills, and networks of individuals; raising private sector productivity; and increasing community competitiveness. Telecommunications plays an essential role as an enabling technology in increasing investment payoffs in other sectors, transforming research and development, facilitating trade in services and globalization, and improving public services to enhance national business environment and competitiveness (Qiang and Rossotto, 2009).

4. CONCLUSION

Although telecommunications development has been found to be one of the factors that affect economic growth, its contribution has varied between countries at different stages of development. This study focused to determine the effect of telecommunication development on economic growth in leading ICT Developed countries for African region. Following previous studies, we used teledensity (or the penetration rate) defined as the number of fixed-line and mobile phone subscribers per 100 persons as a proxy to measure the development of the telecommunications sector in our study. We used the number of fixed-line and mobile subscribers to measure teledensity as mobile communications are taking the stage in the selected African countries. In view of the explosive growth of mobile communications in the past decade, we believe that including the number of mobile phone subscribers in our definition of teledensity is a better proxy to reflect telecommunications development in Africa. Economic growth is proxied by Gross domestic product at current prices (US dollars). Values are based upon GDP in national

currency converted to U.S. dollars using market exchange rates. Our study reveals that as at 2011, Seychelles recorded the highest mobile teledensity of 145.71% followed by Botswana at 142.82% and South Africa at 126.83%. After ensuring data stationarity, the Granger causality test shows no causal relationship between mobile and fixed teledensity and economic growth. However, our OLS result confirms that telecommunication development in Africa influences economic growth positively and significantly. This is because telecommunication development serves as a platform that boosts other economic activities in the region. The results concur with the theory that mobile phones in less developed economies are playing the same crucial role that fixed telephony played in the richer economies in the1970s and 1980s. Mobile phones substitute for fixed lines in poor countries, but complement fixed lines in rich countries, implying that they have stronger growth impact in poor countries. The contribution of mobile cellular phones to economic growth has been growing in Africa region, and the marginal impact of mobile telecommunication services is even greater in areas where fixed-line phones are rare such as in Nigeria, the fastest growing mobile telephone market.

REFERENCES

Alleman, J., C. Hunt, D. Michaels, P. Rapport and L. Taylor, 2004. Telecommunications and economic development: Empirical evidence from Southern Africa. International Telecommunications Society, Sydney. Available from http://www.colorado.edu/engineering/alleman/print_files/soafrica_paper [Accessed 10/10/12].

Chakraborty, C. and B. Nandi, 2003. Privatization, telecommunications and growth in selected Asian countries: An econometric analysis. Communications and Strategies, 52: 31-47.

Cieslika, A. and M. Kaniewsk, 2004. Telecommunications infrastructure and regional economic development. The Case of Poland, Regional Studies, 38: 713-725.

Cronin, F.J., E.K. Colleran, P.L. Herbert and S. Lewitzky, 1993b. Telecommunications and growth: The contribution of telecommunications infrastructure investment to aggregate and sectoral productivity. Telecommunications Policy, 17: 677-690.

Greenstein, S. and P.T. Spiller, 1996. Estimating the welfare effects of digital infrastructure, Working Paper No. 5770. Cambridge, MA.: National Bureau of Economic Research.

Hardy, A.P., 1980. The role of the telephone in economic development. Telecommunications Policy, 4: 278-286.

IMF, 2012. IMF world economic outlook. Available from www.imf.org.

Jipp, A., 1963. Wealth of nations and telephone density. Telecommunications Journal, 30: 199-201.

Johannes, T.A., A.M. Njong and N. Cletus, 2011. Financial development and economic growth in Cameroon, 1970-2005. Journal of Economics and International Finances, 3(6): 367-375.

Karner, J. and R. Onyeji, 2007. Telecom private investment and economic growth: The case of African and central & East European countries. Unpublished Thesis, Jonkoping University, Jonkoping International Business School, JIBS, Economics.

Lichtenberg, F., 1995. The output contributions of computer equipment and personnel: A firm-level analysis. Economics of Innovation and New Technology, 3: 201-217.

Madden, G. and S.J. Savage, 1998. CEE telecommunications investment and economic growth. Information Economics and Policy, 10: 173-195.

Moss, M.L., 1981. Telecommunications and productivity. MA: Addison-Wesley.

Qiang, C.Z.W., 2009. What are the economic and social impacts of the mobile phone sector in developing countries? Propaco's MagazineIssue: 7-9.

Qiang, C.Z.W. and C.M. Rossotto, 2009. Economic impacts of broadband, in information and communications for development 2009: Extending Reach and Increasing Impact, World Bank, Washington D.C.: 35-50.

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

Roller, L. and L. Waverman, 1996. Telecommunications infrastructure and economic development: A simultaneous approach, WZB Discussion Paper FS IV 96-16, Wissenschaftszentrum, Berlin.

Saunders, R.J., J.J. Warford and B. Wellenius, 1994. Telecommunications and economic development. Baltimore: The Johns Hopkins University Press.

Shiu, A. and P.L. Lam, 2008. Causal relationship between telecommunications and economic growth in China and its regions. Forthcoming in Regional Studies.

Sridhar, K.S. and V. Sridhar, 2004. Telecommunications infrastructure and economic growth: Evidence from developing countries, National Institute of Public Finance and Policy, Working Papers 04/14.

Waverman, L., M. Meschi and M.A. Fuss, 2005. The impact of telecoms on economic growth in developing countries, in the Vodafone Policy Paper Series 3. Vodafone: 10-24.

Wolde-Rufael, Y., 2007. Another look at the relationship between telecommunications investment and economic activity in the United States. International Economic Journal, 21: 199-205.

Yoo, S.H. and S.J. Kwak, 2004. Information technology and economic development in Korea: A causality study. International Journal of Technology Management, 27: 57-67.