JOURNAL OF ENGINEERING AND APPLIED SCIENCES

JEAS Journal of Engineering and Applied Sciences 10 (2016-2017)

Empirical Analysis of the Iimpact of Telecommunications on the GDP of Nigeria

[1]Ufoaroh S.U, [2]Kalu C.U [3]Inyiama H.C.

[1,3,] Department of Electronic & Computer Engineering
[2]Department of Economics
Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.
[*]Corresponding Author's E-mail: sufoaroh@yahoo.com

Abstract

The importance of the telecommunication infrastructure cannot be overemphasized. The infrastructure promotes employment opportunities, improves services, create incentives for efficiency and reduces the burden on strained public resources. Though, there are several studies on this line of research, no knowledge is derived on the historical evolution of mobile communication. Therefore the present study will do that and then estimate the relationship between telecommunication infrastructure and economic growth in Nigeria from the period 2000-2016, employing both descriptive and econometric techniques. Findings from the study reveal that GSM has contributed significantly to Nigeria's economic growth whereas teledensity has contributed insignificantly to economic growth in Nigeria. Based on the empirical result, the study recommends government's improvement of GSM operations in Nigeria through the provision of efficient regulatory framework and environment as well as more investment in the sector in terms of increase or improvement in the mobile line penetrations (teledensity) in Nigeria to enhance productivity and economic growth.

Keywords: Telecommunication, GDP, Economic growth, GSM, Teledensity, Nigeria, OLS

1.1 Introduction

Communication has greatly and remarkably evolved since its discovery in the late eighteenth century and since then new wireless communication methods and services have been tested and adopted all over the world. Technological advancement and improvements have facilitated the availability of cheaper, reliable and portable communication equipment, as

well as even more efficient communication techniques. These advancements and improvement are expected to continue even at a faster pace.

The mobile ecosystem is a major driver of economic progress and welfare globally. In 2016, the mobile ecosystem generated about 4.2% of global GDP, a contribution that amounts to more than $3.1 trillion of economic value added. In addition, the mobile ecosystem directly provided employment to nearly 17 million people across the world, and indirectly supported an additional 15 million jobs in other sectors of the world economy. The industry also contributed $430 billion in general taxation, with a further $90 billion paid through spectrum auctions. In the period to 2020, the global economic footprint of the mobile sector will continue to grow, reaching a total economic value of $3.7 trillion by 2020, (GSMA, 2016).

Nigeria is a fast growing market, with economic growth projecting at around 7 percent (double that of Europe and the US). As the largest market in Africa, Nigeria's population also continues to rise at around 3 percent per year. The contribution of the Mobile sector to GDP was found to be higher than originally thought. Telecommunications in particular was estimated to contribute about 9.90 percent to norminal GDP in the third quarter of 2016, up from the earlier estimates of less than 1 percent, (NBS, 2016).

As the most populous country in Africa, Nigeria has attracted a diverse range of network operators. The top four operators are: MTN, Airtel, Globacom and Etisalat.

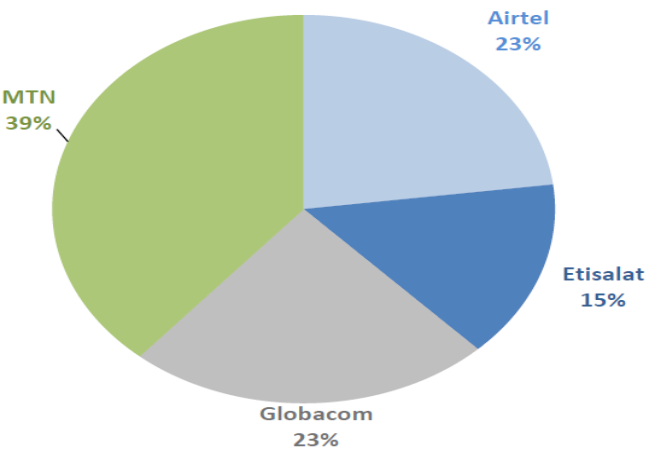


Fig 1: Percentage share of mobile subscribers by Network operators in Nigeria (NBS, 2016)

With an ever increasing population growth, the subscriber base of Mobile networks is expected to rise significantly, which in turn will impact on the nations GDP positively as revenues and benefits accruable from mobile communication services and infrastructure will greatly increase. It is the sole aim of this work to critically look at the impact of this ever

advancing technology and how it impacts on the economic growth of the world with Nigeria as the principal focus.

It is no myth that mobile communication has already redefined consumers' experiences in many aspects of their daily life, as well as created a range of new business opportunities and services. Services provided by mobile communication platform are increasingly changing people's lives in unprecedented ways; they have greatly influenced the way companies do business and have altered the whole notion of public service delivery.

Diverse range of players including mobile operators, entrepreneurs, corporate organisations, governments, investors and non-profit organisations have together driven an explosion in mobile enabled products and services across the developing world, (GSMA, 2017).

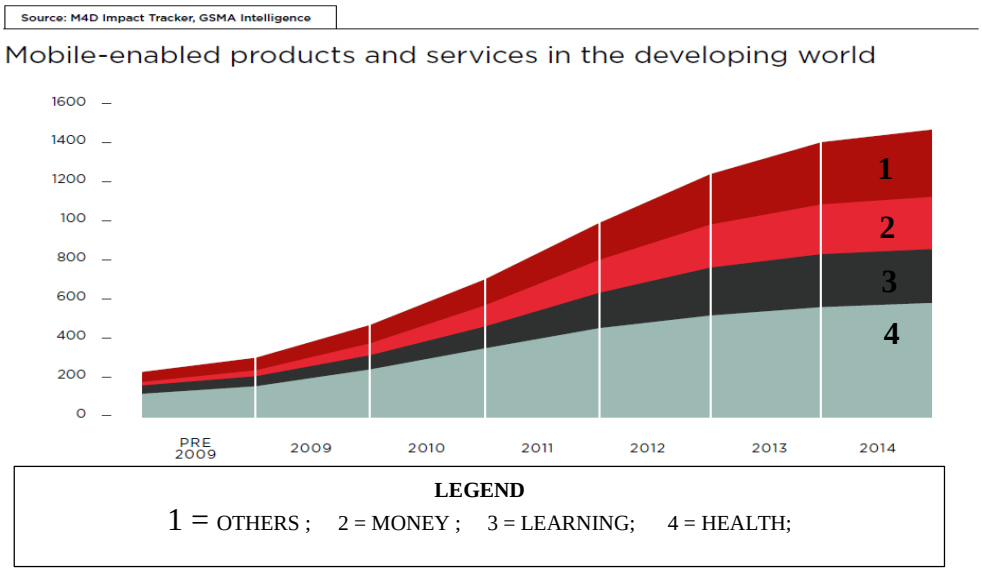


Fig 2: Graphical Illustration of Mobile-enabled products in the Developing World (GSMA, 2017).

It is evident today that the mobile platform with its current strides is gradually emerging as the most powerful and easiest way to provide vital services and economic opportunities to millions of people around the world. Its vast economic opportunities are equally extended to both urban and rural populations. Its contribution spans across various aspects of life and the economic sector. Some of the areas/sector where mobile driven innovations have positively imparted life includes the following:

- **Agriculture**

It is no news today that the agricultural sector is increasingly impacted by climate change. The soil condition, variable weather patterns, and industrial agricultural practices have caused considerable damage to the farming community, particularly in developing countries like Nigeria. However, mobile communication based services deployed to aid agricultural

activities has greatly improved and enhanced farmer's experience thereby improving agricultural practices in developing countries and facilitating better adaptation to climate change. Consequently, this has increased farm yields and revenue.

Mobile based services provide access to weather information, and geographical data. Through advanced mobile based systems soil conditions can be monitored in combination with weather information to determine what to grow, and when to plant, fertilize and harvest crops. Mobile web-access gives farmers' access to information with regards to the length of the growing seasons for crops and the risks (e.g., droughts, floods, and extreme storms) they might encounter during the season. Geographic data provides valuable information on pests and animal diseases, allowing farmers to assess their level of risk.

For instance, according to the system developed by Vandana et al (2013), this system makes use of a GSM module, a microcontroller and a sensor to allow for remote access to the agricultural farmland and machinery. In operation, the sensor is placed in the farm land where it monitors the soil humidity, temperature and rainfall and sends the information wirelessly as an SMS to the farmer's PC where the information is processed and relevant commands are sent back to the GSM module which is then decoded by the microcontroller and then relevant action such as "turn on or turn off" the irrigation machine is implemented without the physical presence of the farmer. With this technology, the farmer needs not to visit the farmland to manually irrigate the land or access climatic related information because the data is collected automatically and stored in the data base.

Also, in order to boost sells and profit from farm produce, a mobile based service called "mAgriculture" (GSMA, 2015), was developed to aid farmers stay abreast of pricing movements, gain access to current market information, take advantage of financial services and supply chain solutions thereby helping them to increase their yield, cost crops or livestock more competitively and grow their business.

- **Health**

Health! It is said is wealth, and a healthy people accounts for a productive nation which would impact the nations GDP. Giving the exigency of health related issues; it is prime to address health related issues the very moment it is discovered since they are essential to existence and productivity. With the advancement in mobile technology, new and improved health care delivery services are being implemented. Mobile based services have made it possible to monitor the changes in health parameters in patients irrespective of time and location so as to provide for measures that will forestall abnormalities and cater for emergencies.

One of such initiative was implemented by Ufoaroh et al (2015); a work centred on heartbeat monitoring and alert system using GSM technology. This work presents a system that provides real time remote monitoring of patient's heartbeat which gives feedback to the medical personnel via SMS. It was designed in such a way that the heartbeat/pulse rate is sensed and measured by means of sensors which sends the signals to the control unit for proper processing and determination of the heartbeat rate which is then displayed on an LCD and also forwarded to the medical expert by means of SMS. The system is also capable of

alerting the medical expert or health personnel, if the threshold value of the heartbeat rate is maximally exceeded.

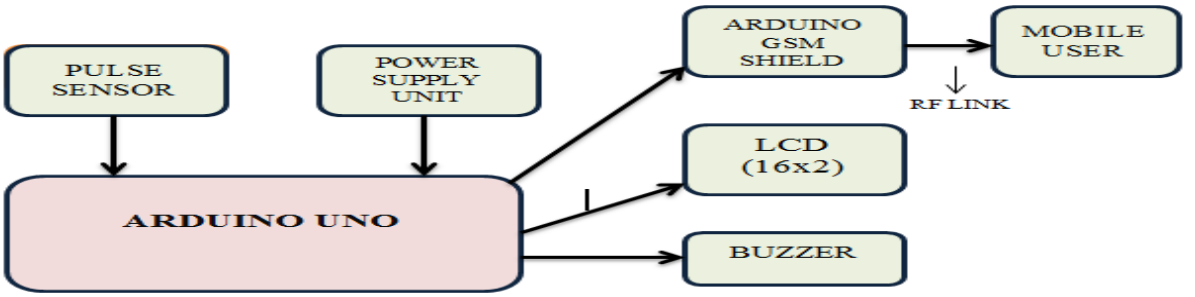


Fig 3: The Block diagram of The Heartbeat Monitoring and Alert System

Another mobile based innovation in the medical sector is called 'Mobile-baby' which is a service being implemented in Nigeria and Tanzania (known as 'Safer Deliveries' in Tanzania), (GSMA, 2015). The service is aimed at reducing mother and child mortality by helping pregnant women in rural areas get medical attention easily. 'Mobile-baby' allows medical practitioners to send ultrasound images, video clips and 3D scans directly from ultrasound machines to mobile phones via SMS, MMS and email, providing real-time remote medical diagnostics (GSMA, 2015).

These services facilitate health care delivery to underserved populations, by successfully addressing challenges such as reducing maternal and infant mortality rates, providing remote real time information on patient's health status, combating infectious diseases, creating awareness of HIV and delivering nutritional health and treatment for a variety of health conditions remotely.

- **Disaster Response**

Before the invention of mobile telephony, prompt response to victims of disaster was rarely obtainable. But with the introduction of mobile communication technology disaster response took a new shift. With recent advancement of mobile technology, Mobile networks plays a vital role in disaster response and crisis management, they facilitate the critical communication between humanitarian agencies and the affected victims.

- **Employment**

Unemployment rates around the world and especially in Nigeria is rising at an alarming rate and some of the main reasons for youth unemployment include lack of appropriate skills and experience, communication barriers, lack of knowledge of available jobs, and inability to travel to work. Many of these challenges can be addressed by mobile technology. Mobile communication 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 such as: Base Station Managers, Site maintenance engineers, Mast installers, Mobile equipment technicians etc.

Also, the development of mobile-based applications provides employment for those skilled in the art, which consequently provides a way out of unemployment. Interestingly, Mobile based platforms also facilitates the easy link between job seekers and their prospective employers. For instance "Jobberman" which also has a mobile-based platform provides a web based platform that connects employers and job seekers thus reducing the frantic search for jobs and provides job opportunity for the masses.

- **Education**

Mobile based platform has really redefined the education sector. With the introduction of Electronic learning (e-learning), the classroom went mobile and digital. Restrictions placed by school buildings have since been taken off; students can actually participate in remote classroom lectures without actually physically being in the class. More educative content is now being made available to student through mobile applications (e.g. e-library). Lecturers can actually deliver lectures from the comfort of their home and students participate via online mobile devices. In Nigeria, some mobile network operators are even going further to provide educational content (Mobile school) without internet, just by the use of SMS and voice.

1.1 Comparative Analysis of Mobile Communications and Economic Growth between Nigeria and the rest of the World

Mobile technologies and services are fuelling economic growth and entrepreneurship, while yielding major social benefits by improving social cohesion, education, financial inclusion and healthcare. With a supportive regulatory framework, the mobile sector will continue to drive socio-economic progress, benefiting individuals, companies and governments alike.

Before the liberalization of the Nigerian Telecom industry, there were just about 400,000 lines with a teledensity of 0.4; but sixteen years later there has been a significant improvement as total active subscriptions as at the end of 2016, stood at over 148.4 million lines with a teledensity of over 99.39. The overall growth in active voice subscriptions was primarily driven by the growth in the Mobile (GSM) market segment. The Information and Communications sector contributed 9.90% to total nominal GDP in the third quarter of 2016, same rate as recorded in the same quarter of 2015. The sector grew by 1.11% in real terms, year on year in the third quarter of 2016. From the rate recorded in the corresponding period of 2015, this was 4.16% point lower and also lower by 0.25% points when compared with rate recorded in the second quarter of 2016. The main driver of this growth was Telecommunications & information services and broadcasting. Quarter on Quarter, the sector exhibited growth of –12.84% in real terms (NBS, 2016).

The statistics shown above projects an increased penetration of telecommunication throughout the country despite the challenges of quality of service provided by the telecoms operators.

The emergence of GSM networks in 2001 resulted in faster economic growth in the sector, with multiple GSM providers operating nationally and a subscribership base nearing 80 per 100 persons. From 450, 000 connected lines in 2001 to over 143 million lines as at September 2015 (ITnewsafrica, 2015)

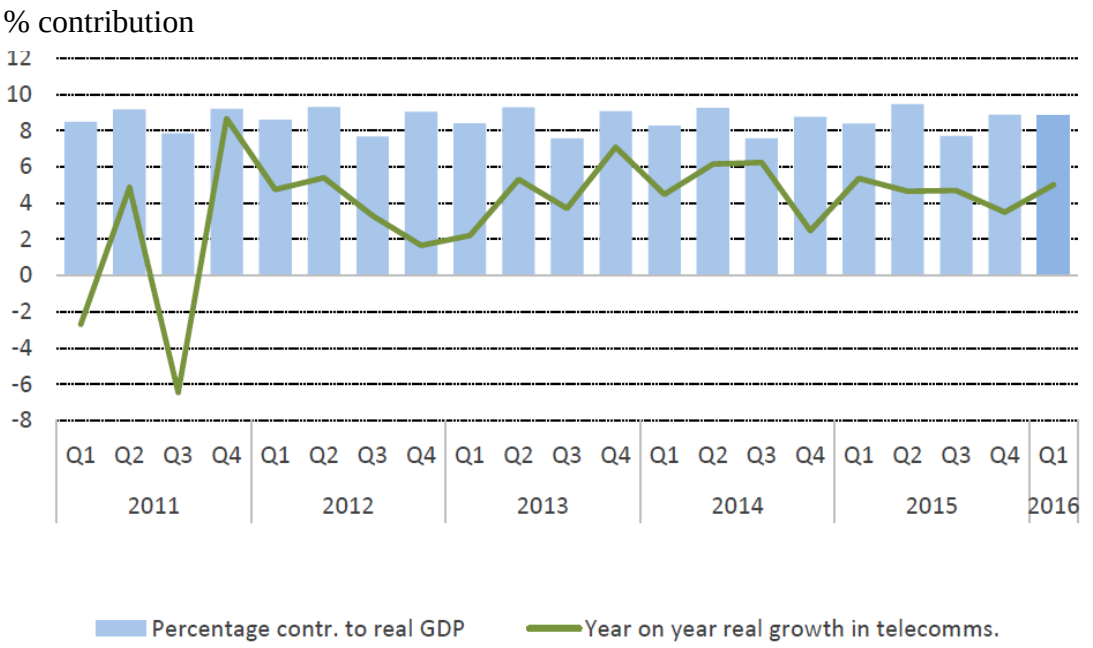


Fig 4: Percentage contribution of Mobile communication to GDP of Nigeria and annual Growth

The y-axis is the percentage contribution to GDP, while Q1, Q2, Q3 and Q4 are the first, second ,third and fourth quarter of each year.

The growing rate of mobile penetration promises to impart positively on Nigeria's GDP. According to NBS, the telecommunication sector recorded a significant growth in the subscriber base from 2.27 million in 2002 when Nigeria issued its first mobile licence to 143.9 million at the end of the first quarter. Of the four telecoms providers, MTN dominated with 61.21 million subscribers, or 42.84 percent of the market. Globacom followed with 30.03 million subscribers, representing 21 percent, while Airtel Nigeria had 28.6 million subscribers or 20.4 percent, followed by Etisalat Nigeria with 22.3 million subscribers or 15.69 percent (NBS, 2015).

The National Bureau of Statistics (NBS) has revealed that the telecommunication sector contributed NGN1,411.74 billion to GDP in the first quarter of 2016, or 8.83 percent, an

increase of 0.5 percent points relative to the same quarter of the previous year. In contrast with the economy as a whole which recorded a real growth rate of -0.36% in the first quarter, growth in the telecommunications sector increased to 5.00% in the first quarter, from 3.49% in the final quarter of 2015, (NBS, 2016).

Nigeria's telecom sector is one of the fastest growing in the world and telecommunications is obviously leading as the aggregate foreign direct investments (FDI) from 2007 to 2013, and ranked as a contributor of 24 percent of such projects. According to Mr. Tony Ojobo, Director of Public Affairs, between the year 2011 and 2013, telecommunications sector attracted about $6 billion worth of investments which has since accelerated information and communications technology (ICT) contributions to an estimated 10 percent, which translated to some $50 billion (ITpulse, 2015).

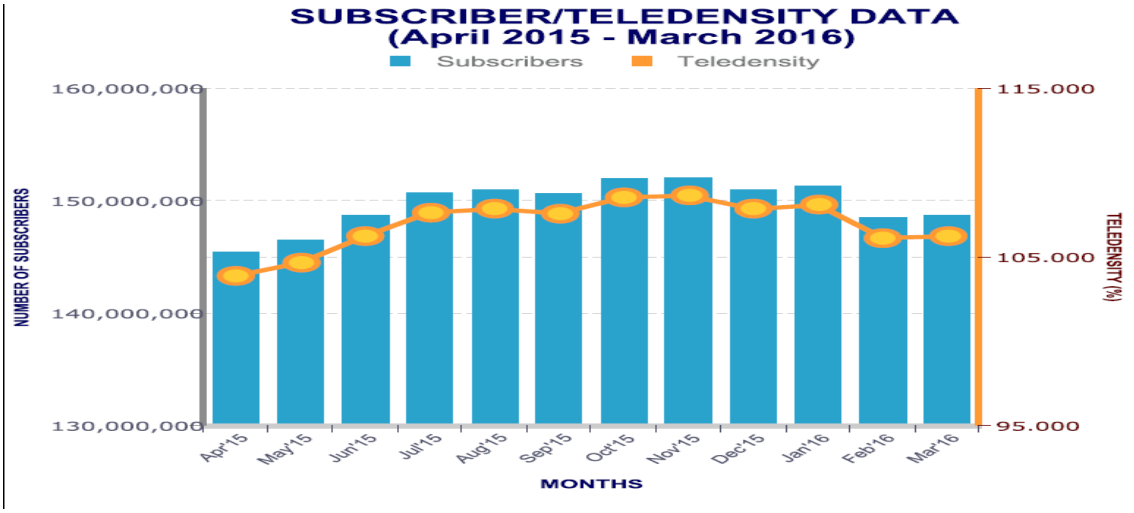
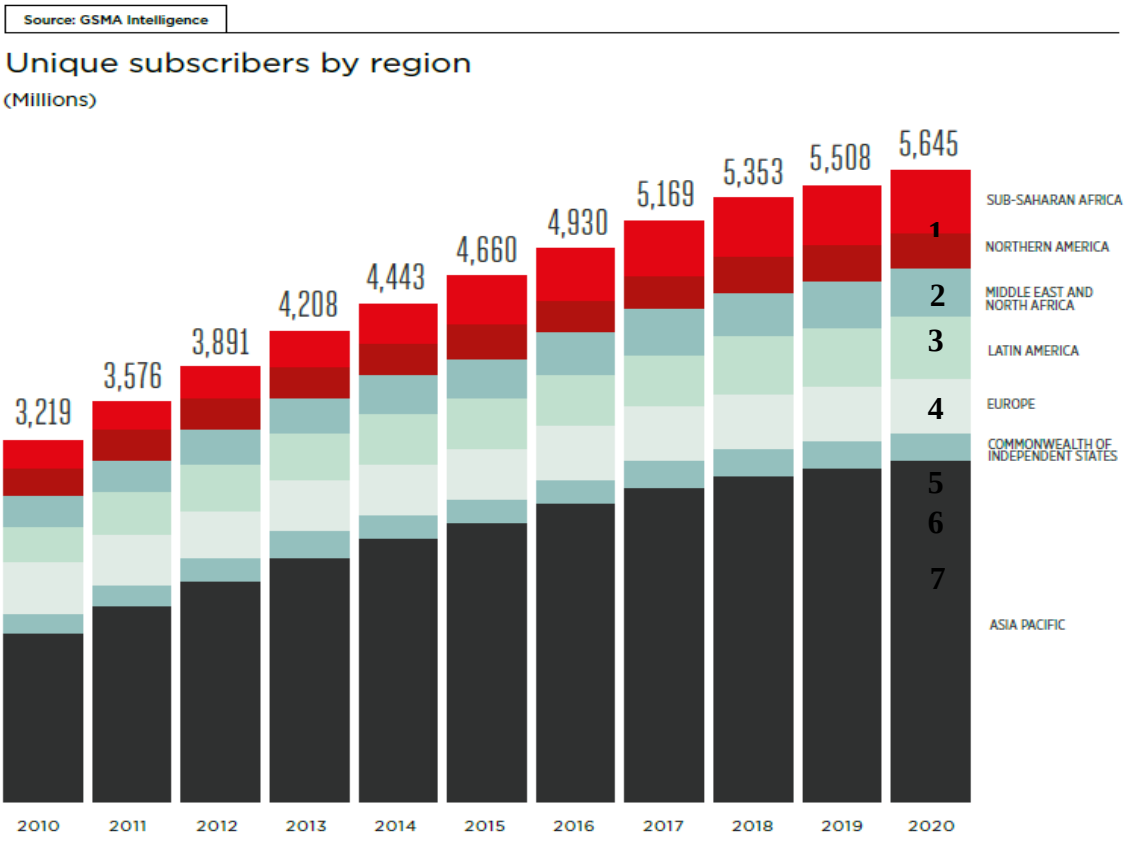


Fig 5: Trend of active subscription and Teledensity in Nigeria (NBS, 2016)

1.2 Contribution of Mobile Communication to GDP of Nations Worldwide

The mobile industry is increasingly helping governments across the world achieve their economic goals. With the increase in subscriber base of Mobile networks around the world the impact on GDP of nations worldwide will definitely be positive.

At the end of 2016, half of the world's population had at least one mobile subscription, totalling over 4.7 billion unique mobile subscribers and by 2020, around three-fifths of the global population will have a mobile subscription, with close to one billion new subscribers added over the period, (GSMA, 2016).



LEGEND

1 = Sub-Saharan Africa ; 2 = Northern America ; 3 = Middle East and North Africa; 4 = Latin America; 5 = Europe; 6 = Common Wealth of Independent States; 7 = Asia Pacific

Fig 6: Graphical representation of Mobile Subscribers by regions Worldwide

Mobile technology has transformed the way in which economic activity is carried out in virtually all the sectors of the global economy, allowing more efficient ways for workers and businesses to communicate and access information. In addition to the direct and indirect contribution to GDP by mobile operators and the wider ecosystem, an estimated 2.2% of global GDP can be attributed to the increased productivity created by the widespread use of mobile technology. This effect varies significantly by country and sector, and contributed over US$1.7 trillion to global GDP in 2016 (GSMA, 2016).

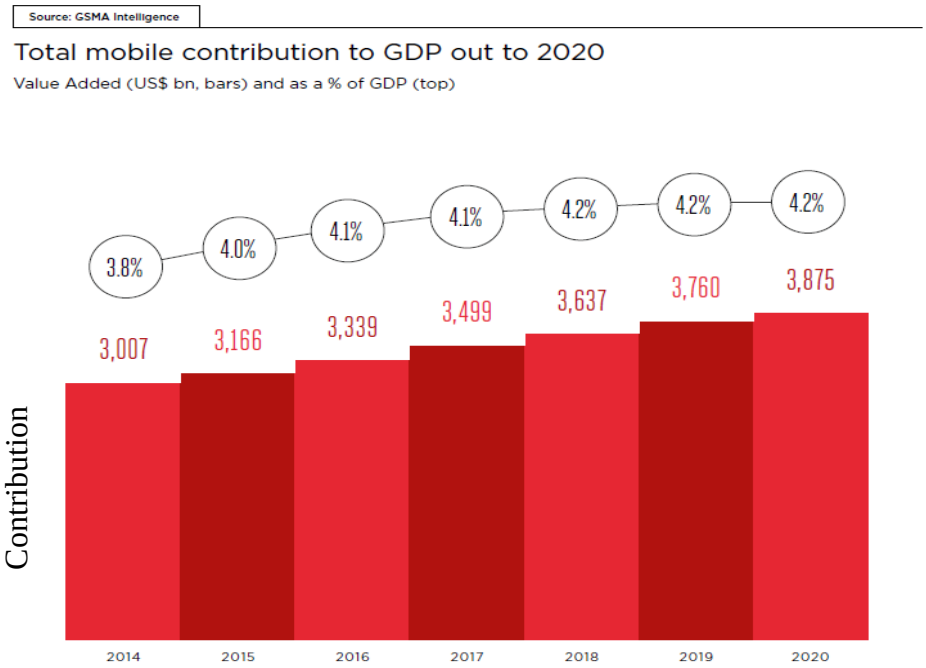


Fig 7: Total Mobile Contribution to GDP world wide

1.3 EVOLUTION OF MOBILE COMMUNICATIONS

It is important to look at a brief history of the evolution of mobile communications throughout the world in order to appreciate the enormous impact it will have on all of us over the next several decades. This section looks at the evolution of mobile communication and its possible future.

- **Zero Generation (0G):**

These systems were the predecessors of the first generation of cellular telephones; this is why they are known as pre cellular or zero generation systems. The first prototype of this generation was the Handie Talkie H12-16, used in the Second World War. These systems also include Push to Talk (PTT), Mobile Telephone System (MTS), Improved Mobile Telephone Service (IMTS), Advanced Mobile Telephone System (AMTS), Offentlig Landmobil Telefoni (OLT), Mobile telephony system D (MTD) and Autoradiopuhelin (ARP), (Jorge, 2016).

- **First Generation (1G)**

This is known as first-generation wireless telephone technology. These are the analog cell phone standards and were introduced in the 1980s and continued until being replaced by 2G digital cell phones (3GPP, 2000) 1G networks use analog radio signals, this technology

modulates voice signals to higher frequency, typically 150MHz and above. Standards that emanated from this technology include: NMT (Nordic Mobile Telephone), used in Nordic countries, Switzerland, Netherlands, Eastern Europe and Russia. Others include AMPS (Advanced Mobile Phone System) used in the United States and Australia, (3GPP, 2000). TACS (Total Access Communications System) in the United Kingdom, C-450 in West Germany, Portugal and South Africa, Radiocom2000 in France, and RTMI in Italy. In Japan there were multiple systems. Three standards, TZ-801, TZ-802, and TZ-803 were developed by NTT, while a competing system operated by DDI used the JTACS (Japan Total Access Communications System) standard, (3GPP, 2000).

- **Second Generation (2G)**

This technology replaced the 1G technology, it was commercially launched on the GSM standard in Finland by Radiolinja (now part of Elisa) in 1991, (3GPP, 2000). This technology brought about digital encryption of phone conversation and allowed for far greater mobile phone penetration levels. It also introduced services such as data services for mobile, starting with SMS text messages. 2G technologies can be divided into TDMA-based and CDMA-based standards depending on the type of multiplexing used. The main 2G standards are: GSM (TDMA-based originally from Europe but used in almost all countries on all six inhabited continents) and IS-95 or CDMAOne, (CDMA-based, commonly referred as simply CDMA in the US), used in America and parts of Asia, (3GPP, 2000).

Further improvement to the GSM family saw the development of Enhanced Data rates for GSM Evolution (EDGE), Enhanced GPRS (EGPRS) or IMT Single Carrier (IMT-SC) which are digital mobile phone technology that allowed for improved data transmission rates. They are extensions on top of standard GSM. Although, EDGE can be considered a 3G radio technology and is part of ITU's 3G definition, but is most frequently referred to as 2.75G, (Jorge, 2009).

- **Third Generation (3G)**

With advancement in technology and an increasing requirement for improved communication experience, the 3G Technology was developed. This technology is based on the International Telecommunication Union (ITU) family of standards under the International Mobile Telecommunications programme; IMT-2000. It provided advanced features such as high-quality images, video and also access to the Web with higher data rates.

- **3.5G**

This technology is a further improvement to 3G technology. It provided better and advanced features than 3G technology. 3.5G technology is a grouping of different mobile telephony and data technologies designed to provide better performance than 3G systems. This technology was developed as an interim step towards deployment of full 4G capability. The technology includes: High-Speed Downlink Packet Access (HSDPA), Evolved HSPA, 3GPP Long Term Evolution (LTE), etc. HSDPA offered such services as Multiple-Input Multiple-Output (MIMO), Adaptive Modulation and Coding (AMC), fast cell search, Hybrid Automatic Request (HARQ), and advanced receiver design.

- **Fourth Generation (4G)**

This mobile cellular technology is the successor to 3G technology. In addition to the services offered by 3G, 4G offers mobile ultra broadband (gigabit speed) Internet access to laptops with wireless modems, smart phones and other mobile devices and also enables multi-carrier transmission. Potential and currently supported applications include IP telephony, gaming services, 3D television, high-definition mobile TV, video conferencing, and cloud computing.

- **Fifth Generation (5G)**

The fifth generation mobile cellular technology is used to denote the next major phase of mobile telecommunications standards beyond the current 4G / IMT-Advanced standards. According to Next Generation Mobile Networks Alliance (NGMN Alliance) 5G networks would provide data rates of several tens of Mb/s supporting tens of thousands of users. Also, 1 Gbit/s is to be offered simultaneously to tens of workers on the same office floor, and several hundreds of thousands of simultaneous connections should be supported for massive sensor deployments. Spectral efficiency should be significantly enhanced compared to 4G. Coverage should be improved. Signalling efficiency enhanced. Latency should be significantly reduced compared to LTE, (Techrepublic.com, 2016) Next Generation Mobile Networks Alliance feel that 5G should be rolled out by 2020 to meet business and consumer demands. In addition to faster speed, 5G networks are predicted to also meet the needs of new use-cases such as the Internet of Things as well as broadcast-like services and lifeline communications in times of disaster, (ngmn.org, 2016).

2.0 Brief Review of Empirical Perspective

The drivers of economic growth in any nation has always attracted the attention of researchers, this has resulted to numerous reviews and analysis. It is with this view that a brief review of some previous works are presented here.

A study carried out by Vuong (2008) revealed that mobile phones promote economic growth using an example of Fishermen in Southern Indian. According to the report, by communicating through mobile phones, the fishermen 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. More so, Roeller (2001) 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.

Deloitte (2009) Based their work on Sudan's economy, they revealed that Mobile telephony has quickly assumed a central place in Sudan's economy: it provides employment in the telecoms sector, provides market information and logistical support in the dominant agriculture sector and it also helps in enabling families to stay in contact in the course of conflicts, migration, and large population displacements. The total economic benefit to the

Sudanese economy in 2008 was estimated at SDG 5,415 million ($2,415 million - rate of 1 SDG = $0.44 Nov 09), which amounts to 4 percent of GDP with a possible additional 1 percent in intangible impact, (Deloitte, 2009).

The work by Leonard (2016) subjected the impact of telecoms rollout on economic growth in poorer nations to a thorough empirical scrutiny. Two different approaches were employed namely: the Annual Production Function (APF) approach and the Endogenous Technical Change (ETC) approach. The latter approach provided the most robust and sensible estimates of the impact of mobile telephony on economic growth. The data on 92 countries from 1980 to 2003 were used to test whether the introduction and rollout of mobile phone networks added to growth. Results obtained by (Leonard, 2016) shows that mobile telephony has a positive and significant impact on economic growth, and this impact may be twice as large in developing countries compared to developed countries.

According to Fredrick (2013) the estimated results show that telecommunication, Foreign Direct Investment (FDI) and the degree of trade openness have positive impact on economic growth in Nigeria while unemployment has negative impact. Fredrick (2013) believes that in a country like Nigeria, where a vast section of the population is below the poverty line, telecommunications offer a chance to empower the residents and transform them into more productive human capital.

Tella (2007) investigated the relationship between telecommunication infrastructure and economic growth in Nigeria over the period 1970-2010 by employing simultaneous equation approach. The study found a positive and significant relationship between the telecommunication infrastructure variables and Real Gross Domestic Product (RGDP).

Bakare and Gold (2011) explored the impact of global system for mobile telecommunication (GSM) on the provision of employment opportunities, income and transaction cost of various economic activities of the masses in Nigeria, employing the profit/loss approach. The result shows that GSM communications has contributed positively to the economic situations of Nigeria and has served as source of income and employment to many Nigerian youth.

The work by Urama (2012) examined the impacts of developments in telecommunications on household poverty level in Nigeria through its impact on household poverty level in Nigeria through its impact on household per capita income, small business turnover, employment and health employing the cross-sectional data from a nationwide survey and the profit model as an estimation technique. The results suggest that developments in telecommunications have a positive and significant impact on poverty reduction in Nigeria.

Gold and Sailu (2012) investigated the impact of mobile GSM on the development and poverty reduction in some selected states in Southwest states of Oyo, Osun and Ekiti of Nigeria. Primary data was collected and analyzed using linear regression analytical techniques. The study found that investment in GSM exerts positive and significant impacts on employment generations, house hold income and reduction in the level of poverty.

In summary, from the reviewed empirical studies, it was observed that GSM and telecommunication infrastructure in general has contributed to economic growth and

productivity in Nigeria. This paper looks at the impact of mobile communications infrastructure on the economic growth of the world at large and focuses on its direct impact on Nigeria's economy by considering recent economic facts and figures while subjecting it to an econometric technique.

2.0 Material and methods

2.1 Data

The data for the study is sourced from the database of Nigerian Communications Commission (NCC) from the period 2000 – 2016. The choice of this period is based on the sectors reform and restructuring. To ensure the readability and linearity of the variables, we consider the natural logarithms of the variables.

2.2 Model Specification

Macroeconomic theory has identified various factors that influence the growth of an economy from the classical, neoclassical and the new growth theories. These factors include natural resources, investment, human capital, innovation and technology (telecommunication infrastructure inclusive), economic policies, institutions and regulations. In order to examine the empirical evidence of macroeconomic factors to growth in Nigeria, the study considers the innovation and technology factors to the growth function for Nigeria as follows: Gross Domestic Product, a proxy for economic growth is a function of teledensity and GSM lines. It is mathematically expressed as:

$$GDP = f(TELED, GSM) \quad (1)$$

Where GDP represents economic growth, TELED represents teledensity and GSM mobile lines. Taking their logarithmic forms, equation (1) becomes:

$$Ln\ GDP = \emptyset_0 + \emptyset_1 Ln\ TELED + \emptyset_2 Ln\ GSM + U_i \quad (2)$$

Where "Ln" represents the natural logarithms, $\emptyset_0$ represents the constant term (average), $\emptyset_1 - \emptyset_2$ is the parameters and U_i represents the error term that has zero mean and variance with stochastic distributions.

Theoretically, we expect the parameter coefficients to take positive signs, i.e. $\emptyset_1, \emptyset_2 > 0$. The inclusion of these variables as explanatory factors are justified on the grounds that previous studies by Tella (2007), Bakare (2011), Olalekan (2012) and Sanjo (2015) have used them in the previous studies.

3.0 Results and Discussions

An examination of the econometric result show that the overall fit is satisfactory with an R-squared of 0.985432 as shown in table 1, thus 98.5% of the systematic variations in the dependent (economic growth, GDP) variables is explained by the variables of GSM and TELED. The F-statistic value of 169.1061 is indicative of the overall statistical significance of the model at the 1 percent level as shown by the P-value. Thus, all the explanatory variables used in the model simultaneously explain the variations in the economic growth in

Nigeria. The Durbin Watson statistics of 1.536 implies rejection of null hypothesis of the autocorrelation.

Table 1: Regression Results on Effect of GSM on the Growth of Nigerian Economy

Variables	Coefficient	Standard Error	t-Statistic	Probability
Constant	10.55028	0.339110	31.11165	0.0000
GSM	0.165212	0.023346	7.076657	0.0009
TELED	-0.004021	0.002822	-1.425070	0.2135
R^2 = 0.985432 ; R^2 – Adjusted = 0.979604 ; F-Statistic = 169.1061 ; Durbin-Watson = 1.536237 ; Probability (F-Statistic) = 0.000026 ;				
Source: Author's Computation				

The coefficient of GSM is correctly signed and statistically significant at 5 percent. Increase in GSM lines and infrastructure is thus a significant determinant of sustainable economic growth. This implies that an improvement in the quality of GSM infrastructure and operations (operators inclusive) in Nigeria will lead to an increase in the level of economic growth by 17 percent, all things being equal. This has further given empirical support to the literature that has linked technology and innovations to be germane for growth.

Contrarily, the coefficient of TELED is negatively related to economic growth against the theoretical expectation. What does one expect in a country where telecommunication is mostly located in the urban centres? The outcome of the variable TELED implies that the usage and penetration is shallow in Nigeria, this could be as a result of poor investment or better still the poor condition of service of telecommunication operators in Nigeria. Moreover, poor institutional framework or weak regulatory framework could be another reason for the weak teledensity in Nigeria. The coefficient of TELED is negatively signed and is statistically insignificant. A one percent increase in TELED will cause GDP to decrease by 0.0040 percent. This indicates that TELED do not have a substantial or statistical significant effort in Nigeria's economic growth in the short-run. However, the result is inconsistent with theoretical postulation.

4.0. Conclusion

The study investigated the impact of telecommunications infrastructure development on economic growth in Nigeria, using annual data from 2000 to 2015. The empirical analysis involves the use of Ordinary Least Square. From the results obtained, the GSM variable is correctly signed and statistically significant at 10 percent, thus signifying that the variables are a determinant of economic growth in Nigeria. The result further supports the forecast and

projections that by 2020, mobile technology is projected to generate a total economic value of nearly USD 4 trillion, increasing the sectors global GDP contribution to 4.2 percent (GSMA, 2016). This also confirms the NBS (2015) forecast that by the year 2020, ICT is expected to contribute 20 percent to the nations GDP.

The empirical result further indicates that TELED variable do not have a substantial or statistical effect in Nigeria's economic growth which is against the theoretical expectations.

5.0 Recommendation

The findings of the study reveal some lessons for policy consideration. TELED variables have a negative effect on economic growth. It is therefore necessary for the government to adopt fiscal and monetary policy measures that will promote more investment in the telecommunications sector especially in the area of usage and services.

The study finds that increase in growth is associated with increase in GSM lines. Hence, the government should strengthen and encourage more lines from the operators by providing a conducive environment and infrastructure provisions.

Further research could also be carried out; such as a more robust empirical technique involving a pre-test and post-test of the variables and incorporation of more telecommunications infrastructure like mobile CDMA, internet services, public payphones.

References

Bakare, A.S and Gold, K.L (2011), "Estimating the impact of global system for Mobile Telecommunications (GSM) on income, employment and transaction costs in Nigeria", Journal of Economics and International Finance 3(1):pp 37-45.

Deloitte LLP (2009) Economic Impact of Mobile Communications in Sudan, report to Mobile Telecommunications Company KSC. (PDF) Accessed 20th June, 2016.

Fredrick Onyebuchi Asogwa, Ohaleme, Kennedy Kelechi, Ugwuanyi Romanus .O. (2013) "The Impact of Telecommunication Expenditure on Economic Growth in Nigeria" Journal of Economics and Sustainable Development ISSN 2222-1700 (Paper) ISSN 2222-2855, Vol.4, No.13.

Gold, K.L, Saibu, M.O and Yusuf, H.A (2012), "Mobile Telecommunications (GSM), its impacts on Household income generating capacity and Business expansion in selected states in Southwest Nigeria", Las Vegas International Academic conference Las Vegas, Nevada USA , The clufe Institute. http://www.clufeinstitute.com/263.

GSMA (2015), " The mobile economy", www.gsmamobileeconomy.com. Accessed 18th March, 2017.

GSMA (2016), "The mobile economy". www.gsma.com, accessed 13th may 2017.

http://www.techrepublic.com/article/does-the-world-really-need-5g. Accessed 18th June 2016.

https://www.ngmn.org/uploads/media/NGMN_5G_White_Paper_V1_0.pdf. Accessed 18th June 2016

Itpulse.com.ng/ict-to-contribute-20-to-nigerias-gdp-by-2020/ Accessed 18th June 2016.

Jorge Vicente Gómezar, (2009) "Third Generation Mobile Technology and its evolution towards Fourth Generation", US Army, Tampere, Finland.

Leonard Waverman, Meloria Meschi and Melvyn Fuss (2016),"The Impact of Telecoms on Economic Growth in Developing Countries" (PDF). Accessed 20th June, 2016.

National Bureau of Statistics, Summary report: q3 2015, 4th February, 2016.

NBS (2015), " Nigerian Gross Domestic Product Report", Quarter Three, 2015, www.nigerianstat.gov.ng

NBS (2016), " Nigerian Gross Domestic Product Report", Issue 11: Quarter Three, 2016, www.nigerianstat.gov.ng

Olalekan, D.O (2012) "Investment in Telecommunications and economic growth in Nigeria: the Granger causality Approach", Journal of Advances in Arts, Social Sciences and Education Research @ Science and Educational Development Institute. 2(9): pg 309-319, September 2012.

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.

RRC Protocol Specification (2000) Third Generation Partnership Project, Technical Specification Group Radio Access Network, TS25.214 (Release 5).

Sanjo, O.M and Oladele, Y.M (2015), "Can the use of GSM induce Business Activities in Nigeria? Evidence from P.Z (Cussion) Nigeria PLC", Global Journal of Commerce and management Perspective 2(3): pp 37-43.

Tella, S.A, Amaghionyeodiwe, L.A and Adesoye, B.A (2007) "Telecommunication infrastructure and economic growth", The 10th International Conference on Telecommunication infrastructure held in Tokyo, Japan. 7th – 8th April 2007.

Ufoaroh S.U, Oranugo C.O,Uchechukwu M.E (2015), "Heartbeat Monitoring And Alert System Using Gsm Technology" International Journal of Engineering Research and General Science Volume 3, Issue 4

Urama, N.E and Oduh, M.O (2012), "Impact of developments in Telecommunications on poverty in Nigeria", Journal of Economics and Sustainable development 3(6): pp 126-145.

Vandana Pandya1 Deepali Shukla (2013), "GSM Modem Based Data Acquisition System" International Journal of Computational Engineering Research (ijceronline.com) Vol. 2 Issue.5

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

www.itnewsafrica.com/2015/07/nigeria-telecoms-contribute-ngn-1-34-bln-to-economy-in-q1/ Accessed 20th June 2016.