Assessing the Impact of GSM Sub-Telecommunication Sector on the Teledensity Rate and Economic Growth in Nigeria: Time Series Analysis

Sulaiman Chindo
Department of Economics
Bauchi State University Gadau-Nigeria
&
Masters Candidate
Department of Economics
University Putra Malaysia
Malaysia

Abstract

As the world becomes a small village as a result of development in ICT, Nigerian GSM sector has changed the whole shape of Telecom industry in the country by improving service providing and creating direct and indirect jobs to the populace. It is however important to assess the impact of this sub-sector on the Economic growth. This study examined and assessed the impact of the GSM sub-sector on the teledensity rate (growth indicator of the industry) using OLS estimator. It must be noted that stationary and co integration tests were conducted before the model was finally estimated. Furthermore, diagnostic checking tests were conducted and the model has been found to be good and stable in conformity with the CLRM assumptions. It was established that GSM has a positive impact on the teledensity rate and economic growth of Nigeria. So also it has been established that GSM sub-sector serves as one of the key contributor to the nation's GDP.

Key Words: GSM sub-sector, Teledensity rate and GDP.

Introduction

As the world is becoming a small village with information and communication serving as necessary tools for globalization process. Nigeria as a country is not an exception in this regard. Nigeria is one of the rare countries of the world that is endowed and blessed with abundant human and natural resources. In spite of this, its economy is characterized by poverty, hunger, unemployment and other social problems. It was in attempt to reverse this trend that economic agenda of the government in 2000 places emphasis on the private sector as the engine of economic growth. This therefore creates room for private participation in various sectors of the economy i.e. Deregulation.

In recognition of the benefits that could be accrued from private participation, the Nigerian Communication Commission (NCC) licensed the first set of GSM (Global System of Mobile) operators in Nigeria. The new licensed entrants were the MTN, MTEL, GLOBACOM and ECONET. Over the past decade of their operations, the sector has recorded huge success from creating jobs to lots more. It is in recognition of this fact that the researcher developed interest in researching into this area to assess the actual contribution of the GSM sub-sector to teledensity rate (i.e. the growth indicator of the industry) and GDP in Nigeria using time series data.

Theoretical Background

Theories have been the basis for every research or analysis. However, in this case there no clear cut theory in economics that can suit this analysis. But, the researcher finds related theory worth of describing the firms' behavior and their activities in the GSM market in Nigeria.

Oligopoly Market Model: GSM Market in Nigeria

Oligopoly market model is a market situation in which there are a few firms selling homogeneous or differentiated products.

It is quite difficult to pinpoint the number of firms in an oligopoly market. There may be three, four or five firms. It is also known as competition among the few. With only a few firms in the market, the action of one firm is likely to affect the others. As I have mentioned earlier, the oligopoly market produces either a homogeneous or heterogeneous products. The former is called pure or perfect oligopoly and the latter is called imperfect or differentiated oligopoly.

The Nigerian GSM sub- telecom sector can be described as pure or perfect oligopoly since all the operators virtually provide same services and sell homogenous products. They are all into call service providing, mobile internet service providing, etc. The GSM market is also characterized by main attributes of oligopoly such as interdependence among sellers in the market, advertisement, keen competition and barriers to entry.

Literature Review

Some number of literatures has been written on telecom industry and some of which will be reviewed here.

Belaid (2002) asserted that fewer studies focus on specific telecommunications infrastructure and their role in economic performance. The main ones emphasize on the contribution of telecommunications in reducing transaction cost, increasing total factor productivity of the private sector and separate of new technologies, which will help to tackle the problem of developing countries. Rickets (2002) in his study saw telecommunications as facilitating the coordination of information flow, provides opportunities for increasing the efficiency of interaction and coordination, and in this manner influences the success of economic activities. Alleman, Rapport and Taylor (2004) asserted that a modern telecommunication infrastructure is not only essential for domestic economic growth, but also a prerequisite for participating in increasing competitive world markets and for attracting new investments.

Further studies conducted for example, Vuong (2008) reported how mobile phone promotes economic growth by lowering the cost of running a business. Also, Roller and waver man (2001), Meshi and fuss (2005) in their studies concluded that telecoms infrastructure can lead to economic growth through many different ways. According to them, investing in the telecom sector itself leads to growth by creating job opportunities, aiding business, etc.

Model Specification

The researcher in trying to assess the impact of GSM-telecom sector on the teledensity rate specifies the following model:

$$TDR = \alpha_0 + \alpha_1 GSM + \alpha_2 FW + U \quad (1)$$

Where: TDR is the teledensity rate of the telecommunication industry of Nigeria. It indicates the growth rate of the telecom industry (growth indicator).
α_0 is the intercept of the model.
GSM stands for the number of GSM lines in circulation in the country.
α_1 is the coefficient of GSM in the model.
FW is the number of fixed wired/wireless lines in circulation in the country.
α_2 is the coefficient of FW.
U is the error term i.e. it represents those factors affecting teledensity rate but are not captured in the model.
Since the analysis is time series one, the model becomes:

$$TDR_t = \alpha_0 + \alpha_1 GSM_t + \alpha_2 FW_t + U_t \quad (2)$$

In order to avoid the problem of abnormality of the distribution. We log the variables as follows:

$$\ln TDR_t = \alpha_0 + \alpha_1 \ln GSM_t + \alpha_2 \ln FW_t + U_t \quad (3)$$

Finally, to take care of autocorrelation and unit root problems that are common to time series data, we differenced each variable in the model.

$$\Delta(\ln TDR_t) = \alpha_0 + \alpha_1 \Delta(\ln GSM_t) + \alpha_2 \Delta(\ln FW_t) + U_t \quad (4)$$

The above model is our final model for analysis.

Data, Estimation and Analysis of the results

In this study, we have sourced our time series quarterly data for the period of 2001 to 2012 from Nigerian Communication Commission (NCC) official website. This data is in quarterly format for the period of 12years of GSM operation in Nigeria. The researcher decided to use quarterly data as annual data of 12years would be small for OLS analysis. But adopting quarterly data of 12years would yield multiple of 47 observations which are enough for OLS analysis.

To begin the OLS estimation, we need to conduct some tests in order to avoid the problem of non-stationary as it leads to spurious or nonsense regression.

Stationary Test:

Table 1: Unit Root Test using Augmented Dickey Fuller Test

Augmented Dickey Fuller Test (ADF)

Variables	First Difference
	Constant with Trend
ΔlnTDR	-3.959469**
ΔlnGSM	-7.300717**
ΔlnFW	-18.28488**

Note: ** denotes significant level at 5%.

The result presented in table 1 is the outcome of ADF test for stationary. All the three variables have been found to be non stationary at level but after taking first difference, they all became stationary as can be seen above in table 1.

Co integration test

It is also pertinent to test for long run equilibrium relationship between the variables. The Johansen-juselius co integration test has been employed and the result is presented below.

Table 2. Johansen – juselius Co integration Test

Hypothesized No. of CE(s)	Test Statistics	Test statistics	Critical values (5%)	Critical values (5%)
	Trace statistics	Max-Eigen Statistics	Trace Statistics	Max- Eigen
None*	76.72292	40.18897	29.79707	21.13162
At most 1*	36.53395	29.54664	15.49471	14.26460
At most 2*	6.987302	6.987302	3.841466	3.841466

Note: * denotes significant at 5% significance level.

Table 2 depicts Johansen-juselius Co integration Test result. It shows that there exist 3 co integrating long run relationships between the variables in the model.

Based on the results of the above two tests for stationary and co integration, the data and the variables are in good shape to apply OLS estimator.

OLS Estimation

The model: $\Delta (\ln TDR_t) = \alpha_0 + \alpha_1 \Delta (\ln GSM_t) + \alpha_2 \Delta (\ln FW_t) + U_t$

Table 3: The result of the OLS Estimation:

Variables	Coefficients	Standard Error	Probability Value
Δ (lnGSM)	0.405398	0.085658	* 0.0000
Δ (lnFW)	0.073499	0.029475	* 0.0166
No. of Observations = 47			

*Level of significance: 0.05 R-squared= 0.531804 Adjusted R-squared= 0.510027 F-test (prob): 0.000000.

The probability value of Δ (lnGSM) and that of Δ (lnFW) show that they are highly significant at 5% (0.05) level in explaining Teledensity rate (Δ lnTDR) in Nigeria.

Also, the coefficient of Δ (lnGSM) is 0.405398 which shows that 40% increase in teledensity rate is brought about by an increase in Δ (lnGSM). It means that 1% increase in Δ (lnGSM) leads to 40% increase in teledensity rate.

Again, Δ (lnFW) (0.073499) is significant and positively correlated with teledensity rate. It means that 1% increase in Δ (lnFW) leads to 7% increase in teledensity rate.

Lastly, the R-squared indicates that the model is good fit with about 53% and the variables which are supposed to be in the model have been captured.

Diagnostic Check Tests

In this study, number of diagnostic checking tests has been employed to check autocorrelation problem, heteroscedasticity problem, normality problem, specification error and stability of the model. The results of some of which would be shown below.

Table 4: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.100683	Prob. F (2, 41)	0.9044
Obs*R-squared	0.224818	Prob. Chi-Square (2)	0.8937

*denotes 5% level of significance.

H_0: No autocorrelation
H_a: autocorrelation exists
The above Breusch-Godfrey Serial Correlation LM Test shows that the p-value of the Obs*R-squared which is 0.8937 is insignificant in rejecting the null hypothesis. Therefore, we fail to reject the null which states that there is no autocorrelation. Hence the model is free from autocorrelation.

Table 5: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.827477	Prob. F (2, 43)	0.0702
Obs*R-squared	5.346380	Prob. Chi-Square (2)	0.0690
Scaled explained SS	7.62250	Prob. Chi-Square (2)	0.0221

*denotes 5% level of significance.

H_o: No heteroscedasticity (homoscedastic)
H_a: Heteroscedasticity exists

Breusch-pagan-Godfrey Heteroscedasticity test in table 5 shows that the p-value (0.0690) is insignificant in rejecting the null hypothesis. Therefore, we fail to reject the null which states that no heteroscedasticity. This means that heteroscedasticity does not exist in the model.

The following figures represent the various trends of FW, GSM and TDR in diagrams in Nigeria over the period of 12 years. The GSM and TDR show an increasing trend over these years while FW increased to a point and started declining due to substitution effect caused by high demand for GSM which substitute FW perfectly.

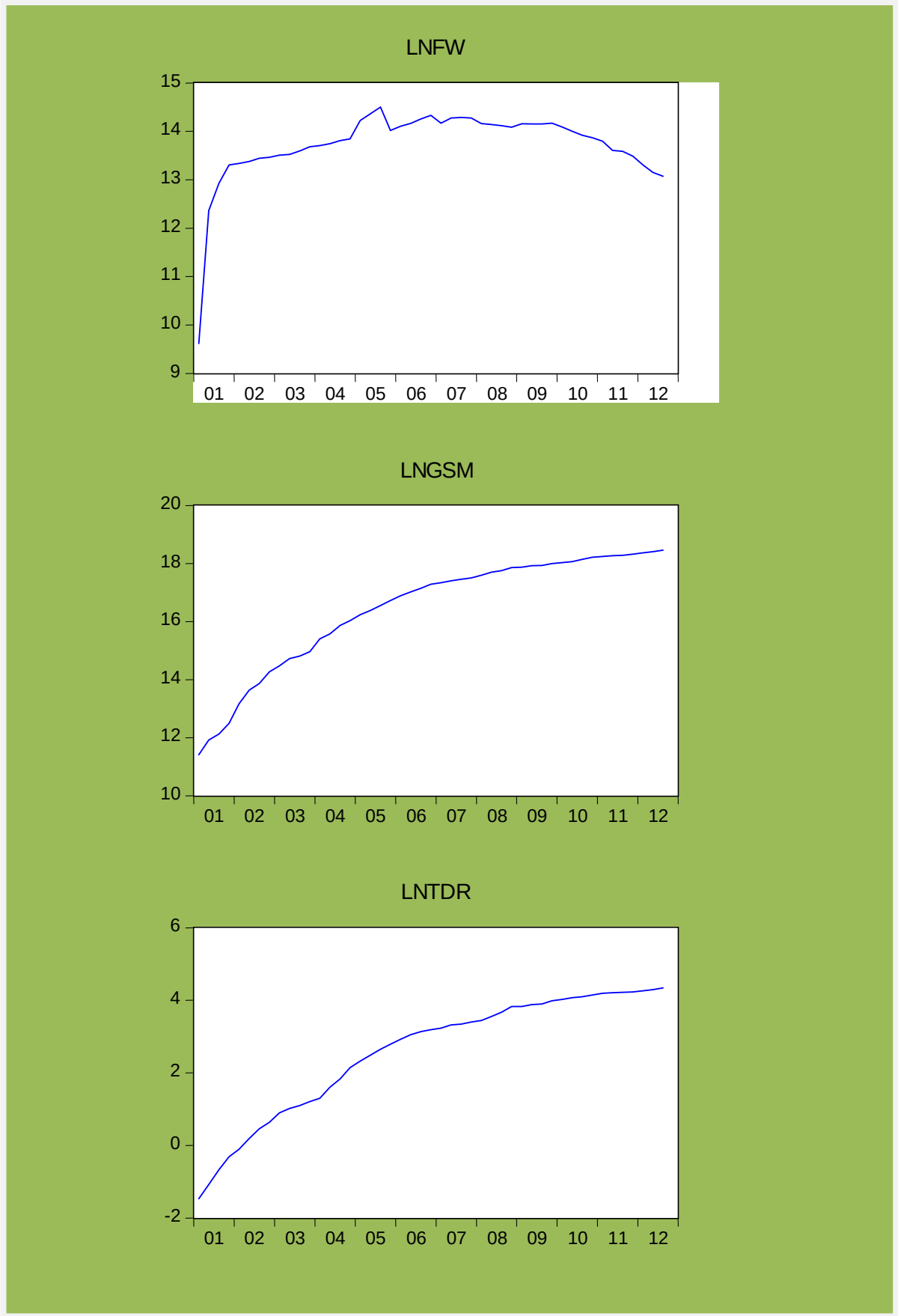

LNFW
15
14
13
12
11
10
9
01 02 03 04 05 06 07 08 09 10 11 12
LNGSM
20
18
16
14
12
10
01 02 03 04 05 06 07 08 09 10 11 12
LNTDR
6
4
2
0
-2
01 02 03 04 05 06 07 08 09 10 11 12

Table 6: The number of subscribers in the Nigerian Telecom industry

Year	Number of Subscribers (all operators in the industry)
2001	866782
2002	2271050
2003	4021945
2004	10201728
2005	19519154
2006	33603761
2007	41975275
2008	64296117
2009	74518264
2010	88348026
2011	95886714

Source: NCC Nigeria

The graphical representation of the number of subscribers in the industry as at 2011.

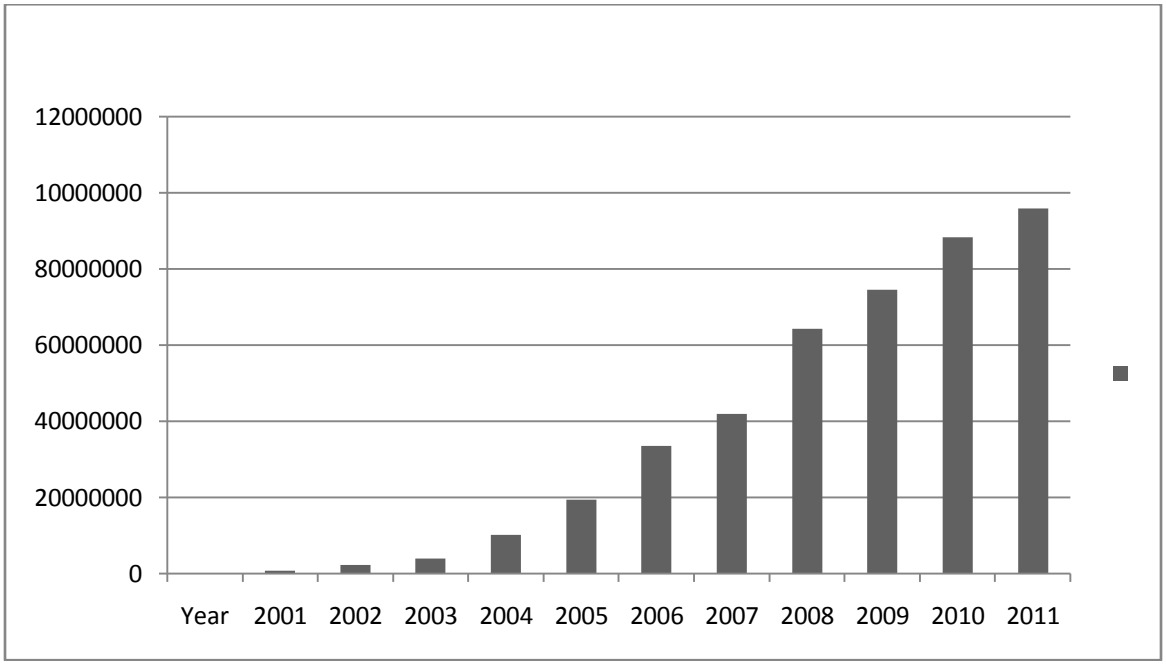


Table 7: The Teledensity rate of the Telecom industry over the period of 11years (2001-2011).

Year	Teledensity Rate
2001	0.73
2002	1.89
2003	3.35
2004	8.5
2005	16.27
2006	24.18
2007	29.98
2008	45.93
2009	53.23
2010	63.11
2011	68.49

Source: NCC Nigeria

The graphical illustration of Teledensity rate of the Telecom industry of Nigeria over 11years

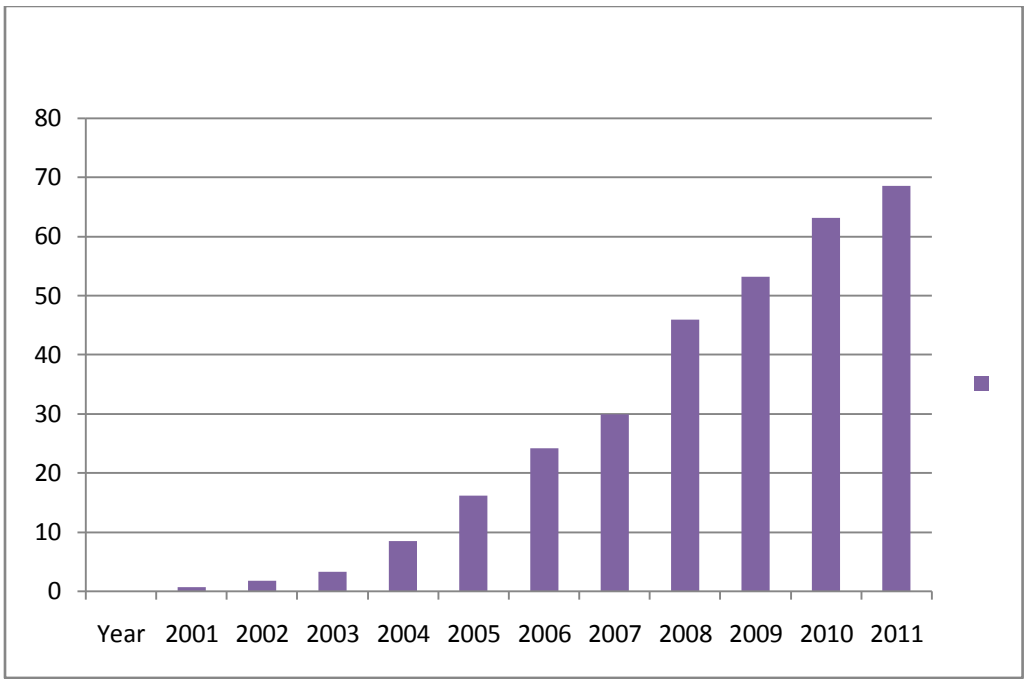


Table 8: GSM Operators and their market share.

GSM Operators	market share
Globacom market share	22%
Airtel market share	20%
Etisalat market share	14%
Mtel	0%
MTN	44%

Source: NCC Nigeria.

Illustration of the market share using pie chart.

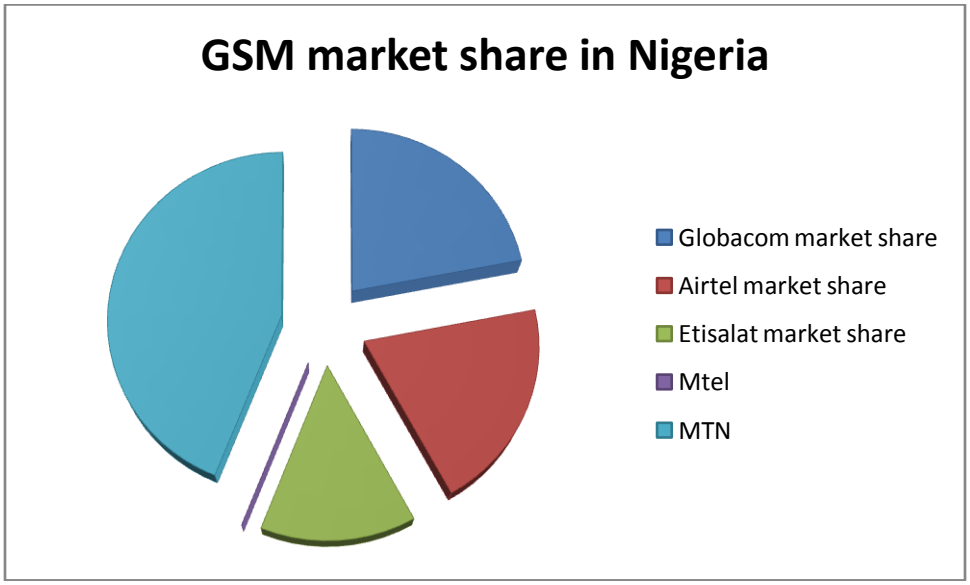


Table 9: Market share by technology of the three groups of operators in the Telecom industry of Nigeria

Operators categories in the industry	Market Share by technology as at sept, 20012
Mobile GSM	96.54%
Mobile CDMA	3.02%
Fixed (Wired & Wireless)	0.44%

Market share by technology represented using pie chart.

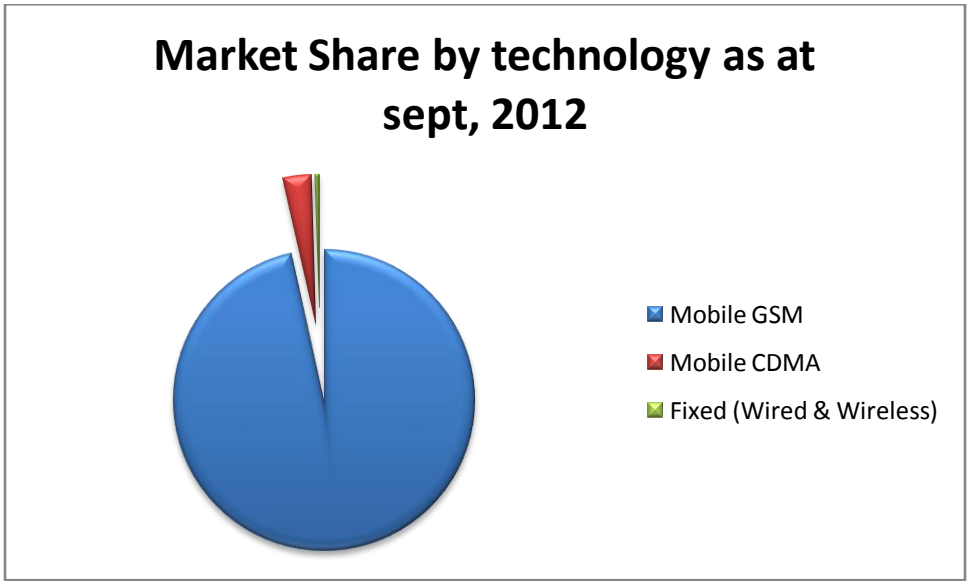
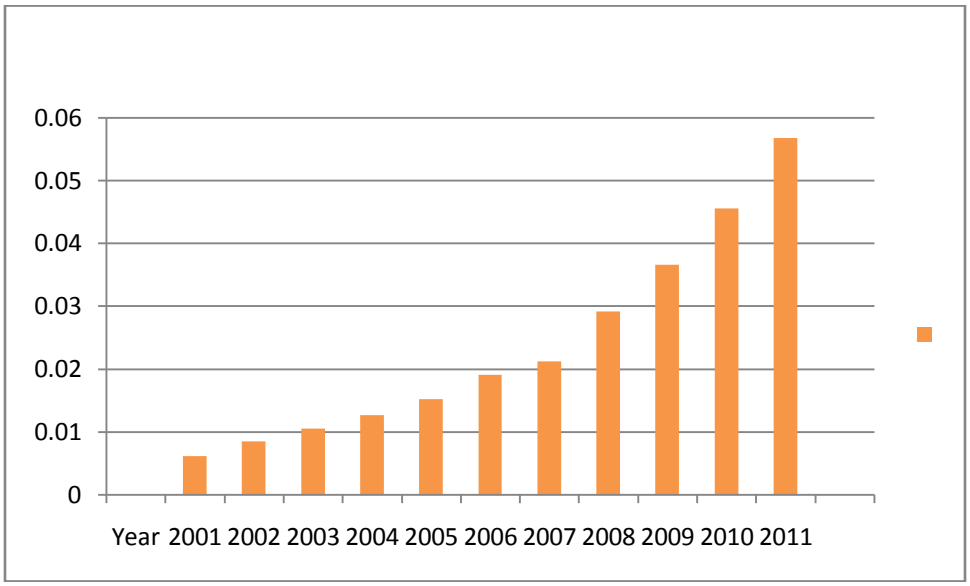


Table 10: The contribution of the Telecom industry to the GDP in Nigeria

Year	% Contribution of the Telecom industry to the GDP in Nigeria
2001	0.62%
2002	0.85%
2003	1.06%
2004	1.27%
2005	1.53%
2006	1.91%
2007	2.13%
2008	2.92%
2009	3.66%
2010	4.56%
2011	5.67%

The graphical illustration of the contribution of Telecommunication industry to the GDP in Nigeria over the period of 11years.



The contribution of the Nigerian Telecommunication industry to the GDP has increased significantly due to the activities of particularly GSM operators.

The impact of GSM sub-telecom sector on Economic Growth in Nigeria

The advent of Global System for Mobile (GSM) has added fillip to the government's battle against unemployment. Since 2001, when the four GSM Companies became operational, more than 10,000 people have directly employed by the companies (Ndukwe, 2004). However, the number employed indirectly by the GSM sub-sector is innumerable to say the least. Scores of new business have come about courtesy of the sector. The list is endless from various levels dealership to cell phone vendors, the vendors of cell phone accessories, the cell phone repair shops, the static and itinerant call shops and the street recharge card hawkers. The last beneficiary of the flood gate of employment offered by GSM revolution in Nigeria is recharge card hawkers.

Teledensity rate and GDP in Nigeria

It has been empirically established that an increase in teledensity rate has a positive proportionate impact on the nation's GDP, Economic and social development. The Nigerian telecoms market exceeded all expectations by being the fastest growing market in the world. In view of its infancy. It is far from realizing its potentials and requires adequate and protection from Nigerian government. The GSM sector has created an extensive value chain of inter-relation and business that have impact every facet of the economy. Over 120,000 viable businesses have created including dealers, distributors, retailers, suppliers and content providers. The socio-economic influence of GSM extends to rejuvenating family and social relationships, narrowing the divide between urban and rural areas, enhancing the level of business in other industries. Today, the telecom sector is a contributor to the nation's GDP.

Summary and Conclusion

The result of the OLS estimator shows that about 40% increase in teledensity rate is brought about by the activities of GSM sub-sector. This means that the sector contributes at least 40% to the growth indicator of the sector. Number of diagnostic checks has been applied to the model such as stationary test, autocorrelation, heteroscedasticity test, stability test, cusum test, normality test and, the model has been found good. Also, it has been established that the GSM market has attracted high demand for its products and services from 2001 to 2012 at rapid rate which made it the fastest growing GSM market in Africa after beating South Africa. The operators in the course of their operation have created a lot of employment opportunities to especially youth and women which reduced the problem of unemployment. Lastly, the sector has become one of the key contributors to the Nigeria's GDP which translate to Economic growth.

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