

# SPECTRUM UTILIZATION AND BUSINESS PERFORMANCE OF TELECOMMUNICATION COMPANIES IN NIGERIA

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## ABSTRACT

The main aim of this paper is to investigate the spectrum (Network) utilization and business performance of the telecommunication system in Adamawa State. The study used descriptive survey design and a total of 240 respondents were drawn from spectrum utilization and various network operators, which includes: MTN Nigeria, Globacom, Airtel Nigeria and 9Mobile Nigeria. The primary and secondary were sourced from mobile network operators in Adamawa state and were used in the study. The data includes questionnaire survey, interviews and record analysis. Content analysis method was used to answer two stages of questions, the interpretive and descriptive questions. However, Chi-square method and frequency tables were also employed in other to test the hypothesis. Data were analyzed using both qualitative and quantitative techniques. It was discovered that there is significant relationship between network utilization and business performance of mobile network providers in Adamawa state. The custodian of spectrum utilization in state was found to have a proper utilization for spectrum of Mobile data network with a little challenge encountered sometimes with frequency interference. It was also noted, that the Mobile Virtual Network operators (MVNO) are not in place in the framework and the spectrum sharing trading scheme are not in place. Based on the findings of the study, it was concluded that the Spectrum utilization is doing its best and in addition, it generated expected revenue for the government and it co-ordinates and monitor radio signals, and it intends to introduce spectrum trading in order to promote spectrum innovations and competitions. The study recommends that spectrum utilization should be encouraged to implement spectrum trading and develop spectrum regulatory framework to administer spectrum trade as it promotes innovations and competitions. With the emergence of new technologies such as cognitive radio and geo-location databases which enables the implementation of new spectrum frameworks, hence such new technologies should be used by the network providers. The government should also allocate more resources for the improvement of spectrum utilization and they should make the policies flexible for implementation of newer technologies.

**KEY WORDS:** Spectrum, utilization, business performance, telecommunication companies.

## INTRODUCTION

The advents of wireless technology have had great impact on globalization of the Nigeria economy since its inception in 2001. The tremendous growth in subscription have brought some challenges to the operators on how to tackle the occurring congestion in the mobile wireless communication posed in their services and have caused a lot of inconveniences to the subscribers. Since its goal is to provide good quality services to the end users (subscribers) with respect to speech, effective roaming globally and lesser tariffs. GSM has become more advanced and handles more subscribers than the analog systems (Carlos and Baker, 2014).

There are over 9 million users of GSM contending for access almost at the same time in Nigeria, making the country one of the fastest growing GSM markets in Africa and the world at large. It is also has that the Nigeria telecommunication market is looking forward to achieve a tele density of 100% by the year 2020 which is driven by the massive telephone and mobile communication improvements thereby requesting for a great increase in the information and communication technology (ICT). Nigeria, with the population density of over 170 million people are being serviced by four major Global System for Mobile (GSM) Telecommunication operators which are

MTN, AIRTEL, GLOMOBILE and 9MOBILE. But among the various operators MTN has the greatest patronage with over 57.2 million subscribers although the competition is getting tighter as the day goes by as operates have to compete for the same potential subscribers (Abdoulkarim, 2015).

Over the years after the start of the GSM era in Nigeria, the focus is now gradually shifting from providing coverage to providing quality service; and the euphoria of owning a phone set is gradually giving way to complaints of dropped calls and congestion among subscribers.

With the increased data demand and emerging technologies, there is an increase need for mobile technology to access the internet to send and receive information ranging from text, voice, images or videos especially to use cloud based systems. This has led to an extreme growth in the mobile industry that has a direct link to economic growth both in developed and developing counties. Recent study originated that a 1.2 percent GDP growth in a developing country is because of 10% increase in mobile penetration However, the portion of the radio spectrum that can be used for many services is very limited, which makes management of the valuable resources

critical for society and national economies (Daniel, 2015).

Nowadays, spectrum utilization most especially spectrum sharing and spectrum trading are under intense confab. Due to an increased use of the wireless network for mobile, there is an increase traffic flow. Traffic Congestion of GSM has always been a major problem and challenge in Nigeria to the service provider and the subscribers.

The Radio Frequency (RF) spectrum as a subclass of the electromagnetic waves has range of frequencies which support a wide variety of activities ranging from industrial, scientific, business, personal, medical research and cultural; these activities can be private or public. Foremost among the variety of activities is communication and other radio services, which have increasing significant value in social and economic development. Due to the increasing level of spectrum uses, Radio Frequency management problems increases and this necessitates the need for this study.

## **LITERATURE REVIEW**

### ***The Concept of Spectrum Utilization***

Promoting efficient and effective use of radio frequencies by proper regulation to increase net social benefit is

the goal of Spectrum utilization. Being a full array of frequency ranging from 3 KHz to 300GHz, the Radio frequency is being use for wireless communication; mobility in this age is key and with the ever-growing need for mobile data and the ascension in wireless broadband due to rapid technological innovation the need for spectrum management and administration is crucial. With this speedy growth and expansion of the wireless service and the rapid movement from 3G to 4G mobile services, signal interference may occur and this is been considered as a major problem of the spectrum use. To protect licensees' signals Exclusive licensing scheme was establish. "Spectrum auction" model as used in many countries improves the efficiency of spectrum use by speeding up technological innovations and this has succeeded the former practice where discrete bands are being licensed to groups that offer similar services (Abdoulkarim, 2015).

Other approaches to spectrum assignment are lotteries, unlicensed access and spectrum privatization, often times the current system for spectrum management proved impaired in its flexibility to accommodate operational requirements and technological innovations rapidly. In order to respond more effectively to Federal

Agencies needs the NTIA and the presidential spectrum initiative tends to provide a widespread IT progresses that helps in simplifying the whole process of getting authorization for spectrum usage thereby coordinating Federal Agency systems, automating both the Federal and Private Agency systems. For the existing Federal Agency, spectrum utilization system to be more responsive to Federal Agency needs, the Presidential spectrum policy initiative and NTIA are implementing an extensive information technology (IT) improvement creating a fast growing sentence for spectrum utilization with the current sharing of functions and network within State, Federal and local entities (Brubaker and Robert, 2012).

### ***Mobile Spectrum Utilization***

Several devices communicate over the airwaves and humanity has benefited enormously from this devices communication. A wide range of information can be sent on the fly across long or short distances without any physical connectors making life so much easier; daily activities depends on this air waved communications; mobile phones, televisions and radio, ship and airplanes navigation and radar, Wi-Fi-connections and microphone signals

making this ubiquitous technologies important giving rise to an information-driven society (Carlos, 2009).

With the increased data demand and emerging technologies, there is an increase need for mobile technology to access the internet to send and receive information ranging from text, voice, images or videos especially to use cloud based systems. This has led to an extreme growth in the mobile industry that has a direct link to economic growth both in developed and developing countries (Lee and Gereffi, 2013).

Recent study originated that a 1.2 percent GDP growth in a developing country is because of 10% increase in mobile penetration. However, the portion of the radio spectrum that can be used for many services is very limited, which makes management of the valuable resources critical for society and national economies (NFMC, 2016).

### ***New Approaches to Spectrum Management***

There is a growing trend towards deregulation and a greater reliance on market forces in spectrum management. Many countries have now started to introduce some form of market-based mechanism in

managing spectrum. At one end of the scale, many countries have retained centralized control over functions such as spectrum allocation while introducing market-based mechanisms, such as auctions, to assign spectrum. At the other end of the scale, a few countries, like Australia, Guatemala and New Zealand, have gone further in deregulating spectrum management by allowing the market-based allocation of spectrum use. While these market-based measures have been introduced within a system of exclusive rights, where spectrum frequencies are assigned for the exclusive use of a licensee, many countries have also allocated spectrum bands for licence-exempt use, effectively allowing more freedom for market players to manage spectrum among themselves.

### ***Changing Paradigms and Convergence in Spectrum Management***

Under static conditions, the administrative management of spectrum can be expected to yield technical and economic efficiencies. However, in the current environment of fast paced technological and market change, centralized administrations have been seen as slow to react, inefficient and biased towards the status quo and incumbent interests. Further taxing this inherent rigidity of the regulatory system, the

increasing “digitization” of information and communications and the resulting convergence of technology also have resulted in the “blurring” of the boundaries between traditional service definitions along which regulators allocated spectrum. Where traditionally different radio communication services were regarded as separate, involving different spectrum allocations, a single platform can now be used to deliver a wide variety of services to customers. For example, broadcasting is moving towards more interactive applications with the introduction of IP data casting, where digital content formats, software applications, programming interfaces and multimedia services are combined through Internet Protocol (IP) with digital broadcasting. Similarly, mobile systems are now capable of delivering access to live broadcasting content.<sup>10</sup> In addition, third-generation (3G) mobile networks are potentially capable of transmitting data rates of up to 2Mbit/s, overlapping with the present performance of broadband fixed wireless access.

Beyond the inherent weaknesses of a centralized spectrum management approach, it is also increasingly acknowledged that market players such as operators and equipment manufacturers possess more knowledge about the spectrum they require

as well as more information regarding the appropriate technologies to deploy and consumer preferences, than an administrative body would. As such, there exists considerable merit in allowing more spectrum management decisions to be made by those who would eventually use the spectrum. Faced with increasing pressures from an unpredictable markets and rapid technological change, a growing number of countries have started de-regulating, or are considering deregulating, portions of their spectrum management regimes; replacing the traditional centralized command and control regulatory approach with more market-based approaches (Hazzlett, 2011).

## **METHODOLOGY**

The research method that was used in this study is descriptive in nature. Research design can be classified in a number of ways which could integrate the degree to which the research question has been crystallized, the method of data collection used, the ability of the researcher to produce effects in the variables which are being studied, the purpose of the study, the time dimension, the scope of the study and also the research environment.

The study population was respondents directly from the Spectrum

administration and other knowledgeable employees in the telecommunication industry. These include engineers, database managers, On the other hand, the respondents were drawn from various network operators, which includes the following:

- a. MTN Nigeria
- b. Globacom
- c. Airtel Nigeria
- d. 9mobile Nigeria

The sampling frame for this study consists of 240 employees. Respondents from the above organizations will be selected randomly, which included engineers, database managers and other knowledgeable employees from various network operators.

In this research three direct-data survey techniques were employed; which includes questionnaire survey, interviews and record analysis.

Content Analysis was used to uniquely analyze and interpret the interviews and questionnaires. Some questions were analyzed using the Likert scale while some responses were assign weight. However Chi-square method and frequency tables were also employed in other to test the hypothesis.

## DATA PRESENTATION AND ANALYSIS

### *Response Analysis on Mobile Spectrum Development, Policies, Guidelines and Trading*

The mobile network operators and the custodians of spectrum utilization in Nigeria have stated out clearly that they do not use spectrum trading and some suggested spectrum trading as a nice idea for proper generation of expected revenue for the government. It was also, strongly agreed that the spectrum utilization Co-ordinate, monitor and keep track of radio signals from space and other foreign countries. These analyses graphically shown below:

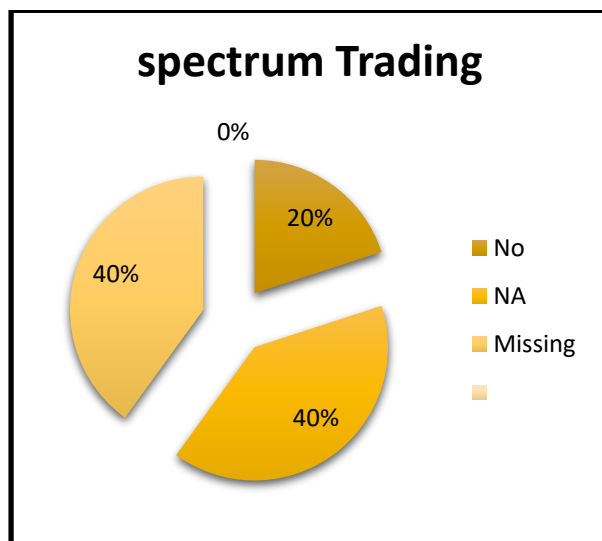


Fig.4.1: Spectrum Trading

**Figure 4.1: Spectrum Trading Analysis**

From the above analysis, it shows that 20% of the respondents attest to the fact that the spectrum utilization does not operate Mobile spectrum trading; this affirmative response came from the spectrum utilization as seen in the response representation table. While only 40% chose (NA) Not Applicable as the question is not applicable to them; the remaining 40% have missing response, as they do not know whether the spectrum utilization allows Mobile Spectrum Trading. From the response it is clearly seen that the spectrum utilization do not allow spectrum Trading.

### *Response Analysis on Mobile Virtual Network Operators*

From the analysis of the surveys it was draw out that, the spectrum utilization does not implement Mobile Virtual Network Operation, and they are of the opinion that it should be implemented, as the State is ripe for it graphically represented below:

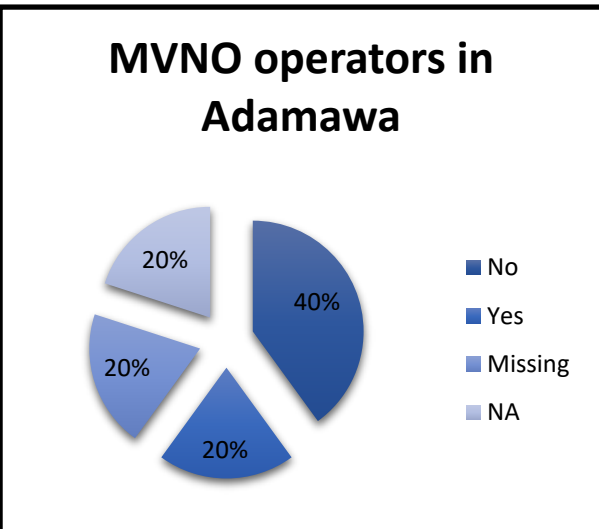


Fig4.2: MVNO operators in Adamawa State

**Figure 4.2: Are there any MVNO in Adamawa Response Analysis**

From the above analysis, it is seen that 40% of the respondents, have a No as response to Mobile Virtual Network Operators not being available in the state, while 20% of the respondents didn't respond; 20% have Not Applicable as this question does not apply to them; the remaining 20% agreed to Mobile Network Virtual Operators (MVNO) being available in the state. Hence it can be concluded that the Mobile Network Operators do not operate in the state if there exist they may be operated informally.

Table 4.1 Chi<sup>2</sup>-Table

Variables	Strongly Agree	Agree	Disagree	Strongly disagree	Row Total
Top-level management	15	11	19	3	48
Middle level management	13	7	6	3	29
Network Operators	20	11	1	1	33
Total columns	48	29	26	7	110

Source: Field Survey (2018)

**DISCUSSION OF FINDINGS**

A detailed analysis using SPSS Tool for data analysis on the questionnaires given out in relation to the spectrum utilization of Mobile network operators in Adamawa and it clearly shows that there is a spectrum utilization framework for Adamawa state which guides spectrum regulation in Nigeria, and these are national laws, with a spectrum



allocation table for mobile technology and technical specifications for national spectrum. The response on mobile spectrum development, policies, guidelines and trading from this research shows that 20% of the respondents they do not use spectrum trading and some suggested spectrum trading as a nice idea for proper generation of expected revenue for the government. 40% of them was also, strongly agreed that the spectrum utilization Co-ordinate, monitor and keep track of radio signals from space. On the Spectrum Trading Analysis 20% of the respondents attest to the fact that the spectrum utilization does not operate Mobile spectrum trading; this affirmative response came from the spectrum utilization as seen in the response representation table. While only 40% chose (D) Disagree as the question is not applicable to them; the remaining 40% have missing response, as they do not know whether the spectrum utilization allows Mobile Spectrum Trading. From the response it is clearly seen that the spectrum utilization do not allow spectrum Trading.

More so, on the responses whether there is Mobile Virtual Network Operators in the state or not, it is seen that 40% of the respondents, have a No as response to Mobile Virtual Network Operators not being available in the state, while 20% of the

respondents didn't respond; 20% have Not Applicable as this question does not apply to them; the remaining 20% agreed to Mobile Network Virtual Operators (MVNO) being available in the state. Hence it can be concluded that the Mobile Network Operators do not operate in the state if there exist they may operate informally.

## CONCLUSION

Based on the findings of the study, it was concluded that the Spectrum utilization is doing its best and in addition, it generated expected revenue for the government and it co-ordinates and monitor radio signals, and it intends to introduce spectrum trading in order to promote spectrum innovations and competitions.

It also, drawn out that the Spectrum utilization does not have A Mobile Virtual Network Operators (MVNO). An (MVNO) is a body of operators, who functions similar to Mobile Network operator (MNO), they offer several telecommunications services, but do not own its own spectrum frequency. In essence, it does not have a direct frequency spectrum gotten from the country's management agency rather; it enters into a legal agreement with an MNO, who already has a radio frequency spectrum. Obtaining

service from MVNOs is of more benefit as it can consumers tailored services to meet their unique need. Another advantage is that MNO get extra earnings as MVNO has rent their infrastructure, which is an advantage over obtaining services from MNOs as MVNOs obtains support both from MNOs.

MVNOs has higher capacity of offering more speed and value added services to their consumers with the increase from 3G to 4G in mobile telecommunications spectrum. Resulting into a more enhanced service delivery of MNOs as they get to categorize and segregate bandwidths for specific needs.

Finally, it was also, drawn out that the spectrum utilization does not allow Sharing of Radio Frequency (Spectrum) which not a universal trend for all regulators is. Spectrum inventories offer opportunities for identifying spectrum supply, assessing its demand and consulting with all stakeholders on the different proposals. This could assist, together with technical studies, in identifying candidate bands for sharing and assessing the feasibility of deployment scenarios for new entrants. In that respect, spectrum inventories could be used by policy makers, following a cost benefit analysis, in the process towards publishing rules for spectrum use. In

particular, they can assist in highlighting underutilization of spectrum and thus, in enabling shared use. Policy makers also need to tackle the existing challenges such as effective authorisation procedures that limit third party access to those instances where spectrum is underutilized, improved mitigation techniques for harmful interference and limited disruption of existing services. Incentive auctions, for example, an innovative approach to transfer spectrum resources from less to more uses that are valuable through market mechanisms.

## RECOMMENDATIONS

The recommendations may be useful for the spectrum utilization and other Mobile network operators in facilitating the spectrum in the country. It is therefore recommended that:

1. The spectrum utilization should be encouraged to implement spectrum trading and develop spectrum regulatory framework to administer spectrum trade as it promotes innovations and competitions.
2. The spectrum utilization should also be encouraged to implement Mobile Virtual Network operators (MVNO) and develop

spectrum regulation framework for MVNO as it grants operators the access to utilize the frequency licenced to the operators and it generates revenue.

3. The emergence of new technologies such as cognitive radio and geo-location databases enables the implementation of new spectrum licensing frameworks, based on the licensed or unlicensed shared use of spectrum. The new approaches proposed for spectrum sharing aim at maximizing spectrum efficiency by allowing a third-party to use underutilized spectrum resources held by government and commercial users or by other stakeholders that do not fully exploit their spectrum capacity, hence such new technologies should be used
4. The government should allocate more resources for the improvement of spectrum utilization and they should make the policies flexible for implementation of newer technologies.

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