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A CRITICAL REVIEW OF THE EVOLUTION OF MOBILE COMMUNICATIONS IN NIGERIA

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Abstract
To many people, the introduction of the GSM into the country has transformed them from unemployed or employee status to employers and successful businessmen and women. The umbrella stand call Centre was a prominent feature in every street of the rural areas and even in the urban areas. Based on secondary sources of information. And the study recommends amongst others Communication is one of the integral parts of science that has always been a focal point for exchanging information among parties at locations physically apart. After its discovery, telephones have replaced telegrams and letters. Similarly, the term 'mobile' has completely revolutionized communication by opening up innovative applications that are limited to one's imagination.

Introduction

Mobile communication is the utilization of technology that permits us to speak with other individuals in various locations without the utilization of any actual physical contact (wires or cables). Mobile communication makes things in our daily life simpler and helps to save time and stress. The first wireline telephone system was introduced in the year 1877. Mobile communication systems as early as 1934 were based on Amplitude Modulation (AM) schemes and only certain public organizations maintained such systems. With the demand for newer and better mobile radio communication systems during World War II and the development of the Frequency Modulation (FM) technique by Edwin Armstrong, the mobile radio communication systems began to witness many new changes.

The mobile telephone was introduced in the year 1946. However, during its initial three and a half decades it found very less market penetration owing to high costs and numerous technological drawbacks.
With the development of the cellular concept in the 1960s at the Bell Laboratories, mobile communications began to be a promising field of expanse which could serve wider populations. Initially, mobile communication was restricted to certain official users and the cellular concept was never even dreamt of being made commercially available. However, with the development of newer and better technologies starting from the 1970s and with the mobile users now connected to the Public Switched Telephone Network (PSTN), there has been astronomical growth in the cellular radio and personal communication systems. Advanced Mobile Phone System (AMPS) was the first U.S. cellular telephone system and it was deployed in 1983.
Wireless services have since then been experiencing a 50% per year growth rate. The number of cellular telephone users grew from 25000 in 1984 to around 3 billion in the year 2007 and the demand rate is increasing day by day (Sucheta and Yadav K, 2013).

Present Day Mobile Communication

Since the time of wireless telegraphy, radio communication has been used extensively. Our society has been looking for acquiring mobility in communication since then. Initially, mobile communication was limited

between one pair of users on single-channel pair. The range of mobility was defined by the transmitter power, type of antenna used, and the frequency of operation. With the increase in the number of users, accommodating them within the limited available frequency spectrum became a major problem. To resolve this problem, the concept of cellular communication was evolved. Present-day cellular communication uses a basic unit called a cell. Each cell consists of a small hexagonal area with a base station located at the center of the cell which communicates with the user. To accommodate multiple users Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), and their hybrids are used. Numerous mobile radio standards have been deployed at various places such as AMPS, PACS, GSM, NTT, PHS, and IS-95, each utilizing a different set of frequencies and allocating a different number of users and channels (Kumaravel, 2011).

Modern Wireless Communication Systems

At the initial phase, mobile communication was restricted to certain social users and the cellular concept was never even dreamt of being made commercially available. Moreover, even the growth in the cellular networks was very slow. However, with the development of newer and better technologies starting from the 1970s and with the mobile users now connected to the PSTN (Public Switched Telephone Network), there has been a remarkable growth in the cellular radio. However, the spread of mobile communication was very fast in the 1990s when the government throughout the world provided radio spectrum licenses for Personal Communication Service (PCS) in a 1.8 - 2 GHz frequency band (Kumar *et al*., 2010).

First Generation Networks (1G)

The Cellular network system first came out in the 1980s where the local area is divided into cells around a limited distance and each served as a base station. These are small Analog systems in which information is sent in Analog signals.The frequency reuse concept can be used in a nearby cell but not in adjacent through which the number of users supported in an area increased a lot. The name given for 1G in those days is cellular phone technology working in a frequency band of 150KHZ.

The first cellular network was launched in Japan by NTT(Nippon Telegraph and Telephone) in 1979 in the Metropolitan area of Tokyo in a short time network has expanded and cover the total population of Japan and became the first nation on the planet to implement the 1G network. Later in 1981 NMT (Nordic Mobile Telephone) extended this technology to countries of Europe (Denmark, Finland, Norway & Sweden). In the USA it was first implemented in 1983 later it spread across UK, Mexico & Canada.

The Technology used in the 1st Generation is AMPS (Advanced Mobile Phone System*)* cellular technology which uses separate frequencies to be held. There is a need for proper bandwidth in this technique for a large number of users.

Example of 1G mobile Phone

Disadvantages of 1G:-

The major disadvantage of 1G is the quality of voice, there was no clarity of noise and a constant disturbance from background noise. The sizes of phones were also very large and the capacity was limited (Sucheta and Yadav, 2013).

Second Generation Networks (2G)

2G cellular technology was launched officially in Finland by Radiolinja in 1991 on the GSM(Global System for Mobile) standard. The technology used in it is completely different from that of 1G. In 2G we use the digital signal for voice transmission with a speed up to 64kbps.2G Technology came up with many data services for mobile. VMS (Voice Mail Service) was also and value-added service in 2G. A new feature Short Message Service (SMS) was added in 2G. It usesa Bandwidth range of 30-200KHZ.

Digital modulation formats were introduced in this generation with the main technology as TDMA/FDD and CDMA/FDD (Agrawal *et al*., 2015).

Example of 2G mobile Phone

2.5G Mobile Networks

2.5G Mobile Networks, to retrofit the 2G standards for compatibility with increased throughputrates to support modern Internet application, the new data-centric standards weredeveloped to be overlaid on 2G standards and this is known as the 2.5G standard.

Here, the main techniques applied are:

- Supporting higher data rate transmission for web browsing
- supporting e-mail traffic
- enabling location-based mobile service

2.5G networks also brought into the market some popular applications, a few ofwhich are: Wireless Application Protocol (WAP), General Packet Radio Service(GPRS), High-Speed Circuit Switched Data (HSCSD), Enhanced Data rates forGSM Evolution (EDGE), etc(Reinhardt, 2005).

Third Generation Networks (3G)

3G is the third generation of mobile phone standards and technology, superseding 2.5G. It is based on the International Telecommunication Union (ITU) family of standards under the International Mobile Telecommunications-2000 (IMT-2000). ITU launched the IMT-2000 program, which, together with the main industry and standardization bodies worldwide, targets to implement a global frequency band that would support a single, ubiquitous wireless communication standard for all countries, to provide the framework for the definition of the 3G mobile systems.

A technique called Packet Switching is used to send the Data. Along with Voice Communication services 3G provides data services to Television, video & services like Global roaming works up to a range of 2100MHZ with a bandwidth of 15020MHZ. It provides high-speed internet services, video chatting, GPS &

Car navigation Digital catalog shopping, Video streaming much faster. Mainly 3G is used as a wideband voice channel in which the whole world is taken as a village and it creates connections from one person to another no matter where the location of each other is (Kumaravel, 2011).

3G Mobile Connectivity

Disadvantages of 3G:- Expense concerning the utilization of 3G is progressive because of high bandwidth transmission of 3G advancements; power utilization which expanded a considerable measure and prompts the decrease of battery life quickly.

Fourth Generation (4G)

The Fourth Generation (4G) of broadband cellular network technology is based on the capabilities defined by the ITU(International Telecommunication Union) in IMT Advanced (International Mobile Telecommunications Advanced) which supersede the 3G. It is popularly referred to as MAGIC (Panagiota, 2015) which is the acronym for "*Mobile multimedia*, *Any-where*, *Global mobility solutions*, *Integrated wireless solutions,and Customized services*."According to the ITU, a 4G network requires a mobile device to be able to exchange data at 100 Mbps for high mobility communication and 1 Gbps for low mobility communication.

4G Mobile Smartphones

Network Standards

There are multiple 4G mobile technology standards used by different cellular providers that conform to 4G requirements, namely, LTE (pre - 4G), LTE-Advanced, WiMAX, and Ultra Mobile Broadband (UMB).

LTE: The UMTS (Universal Mobile Telecommunications Service) cellular technology upgrade termed as Long Term Evolution (LTE), which is also sometimes called 3.9G or Super 3G,is to accomplish higher speeds along with lower packet latency. Several new technologies were introduced by LTE as compared to the previous cellular systems. For example the OFDMA (Orthogonal Frequency Division Multiple Access) technology and the SC-FDMA (Single- Carrier FDMA) technology.

LTE-Advanced: For LTE Advanced / IMT Advanced, the number of key requirements and key features has been specified; some of them are as follows:

a. To have a maximum downlink speed of 1Gbps
b. To have a maximum uplink speed of 500 Mbps
c. To have latency less than or equal to 10ms
d. To have peak spectrum efficiency of downlink as 30bps/Hz and uplink as 15bps/Hz
e. Should possess the ability to support scalable bandwidth upto 100MHz (Manar *et al*., 2009).

MIMO (Multiple Input Multiple Output) and OFDM are two of the base technologies that will facilitate LTE Advanced to achieve high data throughput rates. Along with these, several other technologies will be employed to achieve requirements specified for LTE-advanced (Kumaravel, 2015).

Fifth Generation (5G)

The forecast for the future 10 years' traffic demand illustrates an increase in 1000 scales and more than 100 billion connections of the Internet of Things (Guangyi, 2016). This foists a big challenge for future mobile communication technology beyond the year 2020. Consumers demand high-speed data at low prices. 5G was labeled as 'ultra-fast, ultra-reliable, ultra-high capacity transmitting at super low latency' by the National Infrastructure Commission in the report "5G Infrastructure Requirements in the UK" (2016). Facilities that might be seen with 5G technology include far better levels of connectivity and coverage. The term World Wide Wireless Web or WWWW is being coined for this (Swaroop Gandewar*et al*., 2017).

5G Mobile Network

Set of 5G requirements

5G Technology

Millimeter Waves: Telecom Service Providers (TSPs) make use of the radio frequency spectrum to send and receive data. With an increasing number of consumers, more data is being consumed. But this data remains crammed on the same frequency bands. That means less bandwidth for everyone, causing slower service and more dropped connections. To avoid these problems, TSPs are experimenting with the transmission of signals on a whole new swath of spectrum of 20~50 GHz. This band acknowledged as the mmWave band makes use of higher frequencies than the radio waves that have long been used for mobile phones. The mmWave band from 20~50 GHz alone accounts for 10 times more available bandwidth than the entire 4G cellular band.

Many manufacturers are fostering components that can be operated in the range of millimeter waves and semiconductor technologies that are suitable to operate at frequencies up to 90 GHz, especially in V-band (57 to 66 GHz) and E-band (71 to 86 GHz) applications.

There is one disadvantage to the use of mmWaves, i.e. due to such high frequencies of mmWaves, they are not able to travel through buildings or obstacles and can be absorbed by foliage and rain (Meenal et al., 2014).

Small Cells: Small cells can be placed throughout the cities every 250 meters or so. They are portable miniature base stations that require minimal power to operate. Thousands of small cells installed in the city, due to the short-range of mmWave signals, form a dense network called the HetNet (Heterogeneous Network) that receives signals from other base stations and send them to the users at different locations, like a relay. This largely prevents signals from being dropped. The term 'small cell' encompasses pico-cells, micro-cells, femtocells and can comprise indoor/outdoor systems. Small cells can be as small as the size of a shoebox. Such small cells can be bolted to light poles and the sides of buildings, hence do not require separate towers.

Massive MIMO: MIMO is the acronym for Multiple Input Multiple Output. MIMO refers to a wireless system that uses two or more transmitters and receivers to send and receive more data at once. Presently, 4G base stations possess a dozen ports for antennas to handle all cellular traffic. But 5G base stations can support about a hundred ports, which means that a single array can accommodate many more antennas and hence can send to and receive signals from bountiful users at once. This leads to an increase in the capacity of mobile networks by a factor of 22 or more.Below is a list of key technological characteristics of massive MIMO.

1. Fully digital processing: every antenna bears its own RF (Radio Frequency) and digital baseband chain. The signals emitted from all the antennas at each base station (due to MIMO) are processed coherently

together. Fully digital processing allows to measure complete channel response on the uplink as well as quickly responds to such changes in the channel.

2. Computationally inexpensive pre-coding/decoding: As there are more than one transmitter and receiver in a MIMO network, there exists one LOS path from every transmitter to every receiver ideally. However, there may be reflection or diffraction from the surrounding atmosphere and the signals could interfere causing a low SNR (Signal to Noise Ratio) at the receiver. Hence the data streams cannot be decoded effectively. To avoid this pre-coding is used on the transmission side to equalize the signal reception across multiple receiver antennas.

3. **Channel hardening**: Due to microscopic changes in the environment, the channel gain tends to fluctuate randomly. This is known as channel fading. The channel is said to have hardened when the fluctuations in gain do not impact the transmitted data. Channel Hardening effectively removes the effects of channel fading. Operationally, each terminal-base station link forms a scalar channel whose gain stabilizes to a deterministic and frequency-independent constant.

4**.** The reliance on the reciprocity of propagation and TDD (Time Division Duplex) operationreciprocates the need for prior or structural knowledge of the downlink propagation channel since the downlink channels can be estimated from uplink pilots.

5. The array gain offers the link budget improvement and the spatial resolution of the array results in interference suppression. This facilitates the provision of uniformly good quality of service to all terminals in a cell.

Beamforming: Beamforming reduces the interference for nearby users by recognizing the most efficient data delivery route from a cellular base station to a particular user. Beamforming can help massive MIMO arrays for more skilled use of the spectrum around them. Massive MIMO faces a challenge to reduce interference while transmitting information from many antennas at once. At massive MIMO base stations, the best transmission route is plotted using signal-processing algorithms to send individual data packets in many different directions, bouncing them off buildings and other objects in a precisely coordinated pattern. Beamforming allows the exchange of a lot of information between the users and antennas on a massive MIMO array by choreographing the packets' movements and arrival time. Beamforming and the devices that support beamforming work under the IEEE 802.11ac specification (Payal and Kumar,2014).

Development of mobile communications in Nigeria

From time immemorial, information and communication have formed the basis of human existence. People want to reach others and to be reached. This desire has been a driving force, motivating men to continuously seek a new and effective means of dissemination of information to one another on a real-time basis irrespective of distance. The explosion in technology ushered in this desire with the advent of the first generation cellular telephone systems that enable people to communicate with one another irrespective of time and place. This first-generation cellular telephone system, which was an analog system, was launched in the 1960s before digital communication became prevalent (Goldsmith, 2005).

By the end of the 1980s, it became apparent that the analog cellular systems would not be able to meet continuing demand in instantaneous information of the next century unless something was done about two inherent limitations of the analog cellular systems: severely confined spectrum allocations; and incompatibility among the various analog systems available (Redl *et al*., 1995).

This led to the convergence of the Europeans on a uniform standard for second-generation digital systems called GSM, originally stood for Group Spéciale Mobile, but later changed to Global Systems for Mobile Communications. This development of GSM in the world was prompted by the need to provide seamless telecommunications throughout Europe. The initial release of GSM was called GSM Phase 1 and is generally referred to as the 1G or first-generation (Ajiboye *et al*., 2007). This release made provision for the basic voice, short message service (SMS), and circuit-switched data (CSD).

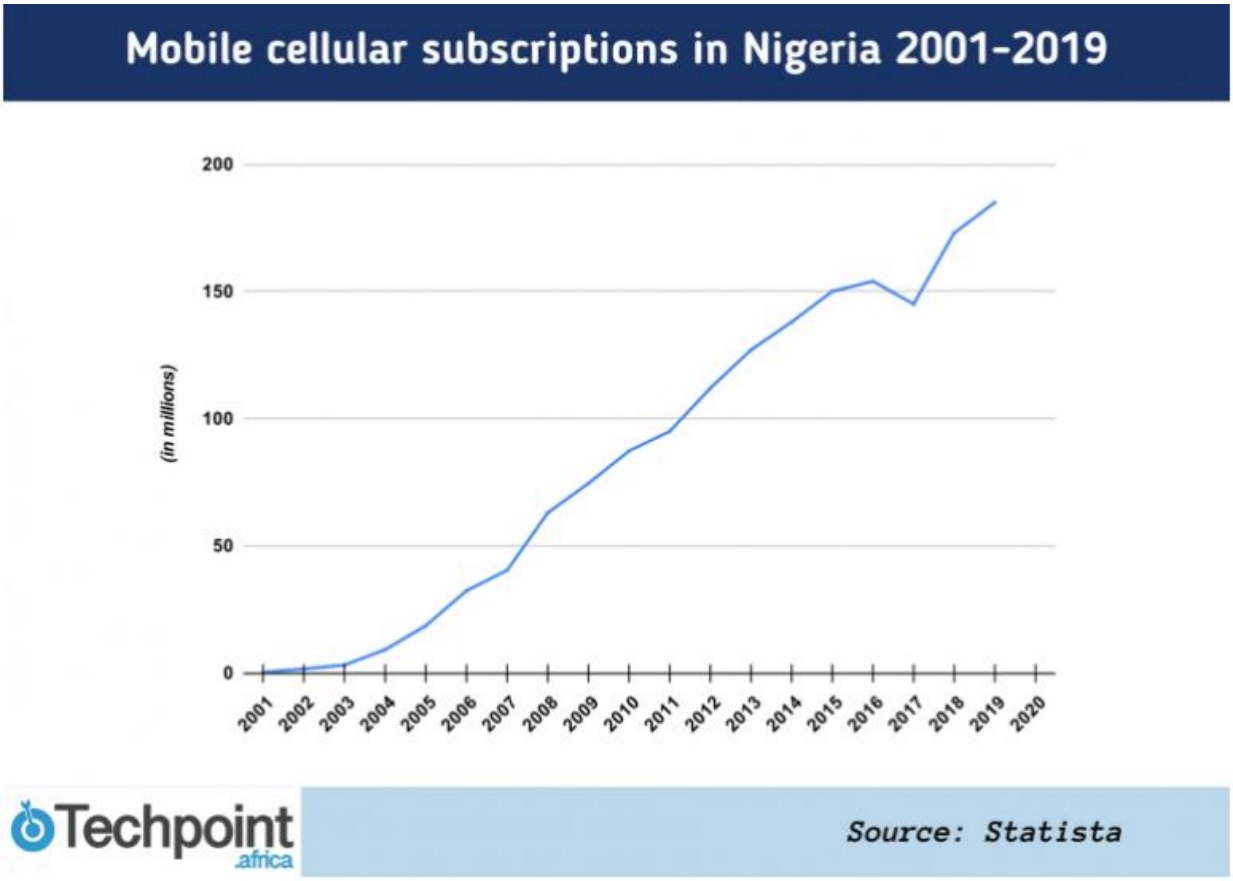
At the beginning of the 1990s, the lack of a common mobile system was seen to be a general, worldwide problem. This led to the birth of the second generation or GSM Phase 2 (2G) which was released in 1995

with enhanced supplementary services. From this development, the GSM system has spread to Eastern European countries, Africa, Asia, and Australia (NOKIA, 2002). However, the GSM usage did not commence in Nigeria until August 2001. Nevertheless, since the inception of GSM in Nigeria, mobile telephony has rapidly become the most popular method of voice communication in the country. Its growth has been so rapid that Nigeria has been rightly described in various media as one of the fastest-growing GSM markets in the world (Adegoke *etal*., 2008).

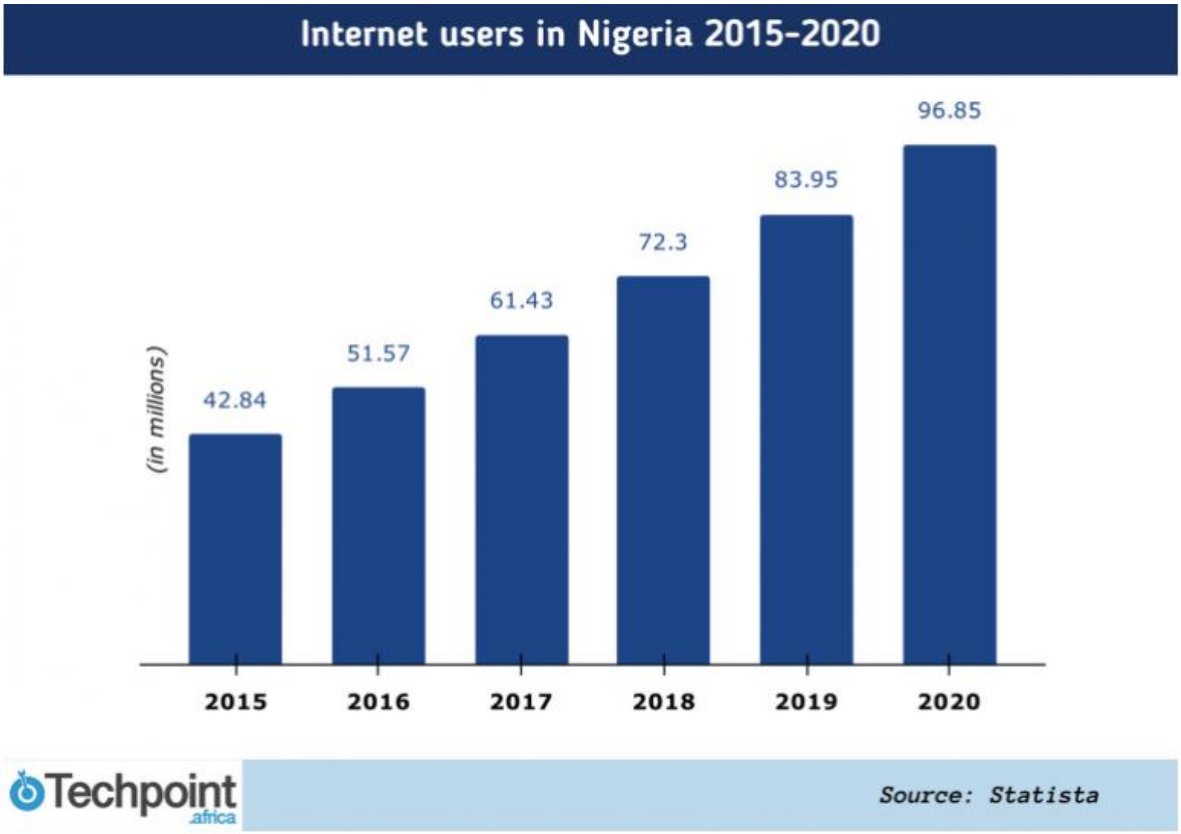
Before the advent of GSM in Nigeria, telephones were a luxury that a few privileged Nigerians enjoyed. However, with the advent of GSM, communications in the country had witnessed a tremendous boost. According to Hassan *et al*. (2009), from less than 500,000 active fixed telephone lines as ofthe middle of 2001, the total number of connected (fixed and mobile) telephone lines had increased to about 22.9 million as of March 2006. The figure has increased dramatically to 12 million by the end of 2007, with GSM or mobile lines accounted for about 91% of the total active telephones (fixed and mobile) lines (Ajiboye *et al*., 2007).

Communication is a major driver of any economy. Nigeria is part of this race for rapid developments, as the years of economic reversal via mismanagement have had adverse effects on its rate of growth and development. The Nigerian telecommunications sector was grossly under-developed before the sector was deregulated under the military regime in 1992 and placed under the jurisdiction of the Nigerian Communication Commission (NCC). Since then, the NCC has issued various licenses to private telephone operators. These licenses allow private telephone operators (PTOS) to roll out both fixed wireless telephone lines and analog mobile phones. The return of democracy in 1999 however paved the way for the granting of GSM licenses to three service providers, MTN, ECONET (which is now V-MOBILE), and NITEL plc in 2001.
This scenario was further spiced when the NCC granted a license for a second National operator (NSO) to GLOBACOM Nigeria on August 12, 2002. The motive was to create an alternative network to the government-owned NITEL and the other two existed operators MTN and ECONET. The license involves the following National carrier service: Digital/ mobile service, long-distance communication, and fixed wireless access service therefore, the obligation to be met by GLOBACOM included the provision of 150,000 digital lines on its mobile network and 100,000 fixed-line networks within the first 12 months of operation. In trying to meet the challenges of itspredecessors in the GSM industry, GLOBACOM signed an interconnectivity agreement with MTN Nigeria and appointed over 350 dealers nationwide on Friday 29th Aug. 2003, GLOBACOM now known as GLO mobile rolled out its services in Abuja and true to their earlier promise, they introduced a per-second billing system with a tariff of 5O kobo per second for the pay-as-go subscribers. Reliable information reveals that a SIM line (card) cost 8,400 Naira with a mandatory 2,000 Naira credit and 18,400 Naira for a SIM line and phone set. They promised to roll out their services in Lagos, Port Harcourt, and Ibadan before December 2003 ((Bakare *et al*., 2017).

Given the activities of GLOBACOM, it is expected it will be able to create a more competitive environment in the Industry. Official statistics show that Nigeria has a telephone subscriber base of about 70million (NCC, 2010), of which about 62million are GSM subscribers. Before now, telephone access was exclusively reserved for the rich and privileged few in the country until 2001 when the GSM was introduced.
Over the years, mobile devices have become accessible and relatively affordable and beyond that are the measurable trends that the country has recorded in the process.
Nigeria has recorded a steady increase in mobile phone users since 2001. According to Statista, the country moved from 270,000 cellular subscriptions in 2001 to 185 million in 2019.



In a different dataset, the country experienced a 55.7% increase in Internet subscribers between 2015 and 2020, with a five-year projection showing a consistent climb.



The Impact of Mobile Communications in Nigeria

The impact of GSM in Nigeria cannot be overemphasized. The advent of GSM has touched life, directly and indirectly, increase communication, businesses, ways of life, etc. According to Ernest Ndukwe, the revolution of information and communication technology (ICT) has brought assurance to many people especially low-income earners that they can feed themselves or their families, provide shelter for selves and have a secured future. The Global Service for Mobile communication (GSM) serves as a tool for economic, political, and social interactions among people of all professions, classes, and statuses. The GSM has improved the capacity of small-scale entrepreneurs who rely on it as an important means of communication needed to be able to do their jobs. The GSM usage has also helped to bridge the communication gap between urban and rural dwellers as was witnessed in the Niger Delta area of Nigeria. He also noted that about 80% of Nigeria‟s population is located in rural areas and to ensure the people‟s security, there is an important need for access to information and knowledge. The telephone which was reserved exclusively for the rich can now be accessed by the mass due to the introduction of GSM.

The rural dwellers have been involved in small businesses such as the telephone or GSM call centers. To many people, the introduction of the GSM into the country has transformed them from unemployed or employee status to employers and successful businessmen and women. The umbrella stand call Centre was a prominent feature in every street of the rural areas and even in the urban areas (Bakare *et al*., 2017).

The cellular phone has contributed greatly to the Nigerian economy by increasing the country's Gross Domestic Product (GDP). The introduction of GSM has increased employment opportunities, sustained livelihood, developed micro-enterprises, promoted growth in the financial, agricultural, and educational sectors, and improved industrial efficiency. Inasmuch, the Information and Communications Technology aided the Nigerian's GDP to grow to 1.62 percent (Ahmad, Ibrahim & Oye. 2011). From 2000, Nigeria's GDP was $110.5 million but rose immensely to $294.8 million in 2008. Moreover, ICT has reduced the

unemployment rate within these years from 34.53 million people to 8.59 million people (Ahmad, Ibrahim & Oye. 2011).

Contributing to this was cellular phone usage promoting research in markets/business transactions. Fortunately, the cellular phone covered large geographical areas, creating increased product and materials research and promoting more business. Cellular phones increase the accessibility of information for market strategies, thereby eliminating the need to employ intermediaries. Moreover, it covers a wider area as compared to other media such as newspapers, etc (Aker & Mbiti, 2010). Calls are made and information is received immediately promoting faster business transactions. Improved communication among firms led to increased productivity. Mobile phones helped managers improve the supply chain management of their companies. Thus, the managers use cellular phones to effectively trade off some unnecessary production processes and engage in more innovative ideas and production. In addition, cellular phones are used in the trading activities such as checking initial identity and possibility of ordering, seeking orders, searching for and confirming the presence of raw materials, confirming credit arrangements and pick up of raw materials by a representative, etc. The improved communications by the managers provide the availability, cost, quality, and other characteristics of information (Heeks, Jagun, & Whalley, 2008). The supply chain management increased profits and aided in the supply chain management for industries.

Considering growth brought to education sector by the Net, it is obvious Nigeria educational sector cannot stand the test of time without the internet. Also, the impact of internet in sending and receiving of e-mail has indeed changed the postal services in Nigeria with the internet giving Nigerians the opportunity to send and receive instant messages across the world. Similarly, internet has indeed contributed positively to Nigerians business transactions. The uses of electronic data have enabled Nigerians to do business at anytime and anywhere. Different banks' customers can withdraw their money at any part of the country as a result of impact of internet on Nigerians banking system. Also, the introduction of the Net enable ATM has drastically reduced the queue in banks across the country as well as in other parts of the world.

More impacts of mobile communication in Nigeria are as follows:

1. **Employment:** For the individual users in the country, the cellular phone has created jobs that have impacted the countries' economy. The cell phone phenomenon has been incorporated into a variety of business and entrepreneurship opportunities. Especially for low-income earners, it is a source of sustainable livelihoods such as engaging in the selling of (Subscriber Identification Module) SIM cards and other cellular phone-related activities. All these activities provide enough money for food, shelter, maintenance, and other various expenses for them and their families. It is a form of sponsorship of other businesses. People who cannot afford credit facilities to finance their business depend on GSM businesses to raise and save money for other businesses of their interest. Moreover, students engage in GSM business to raise money for their tuition fees and other educational expenses (Adesope& Efe-Omojevwe, 2010).

2. **Reduction of Poverty:** Cellular phones provide new ways to reduce poverty in the country. Further, they have played the roles used to combat poverty and empowered the people especially the rural dwellers (Goon, Han, Lee, Muda &Nair, 2012). Cellular phones raised the standard of living of the poor and marginalized societies. For example, less privileged people in the rural areas can conduct their microcredit financing businesses with the use of their phones, therefore increasing businesses and promoting the standard of living. It has been used to breach the gap between the rich and the poor in society providing the knowledge to maximize time, resources, and efforts. Efe-Omojevwe, Zelda &Adesope (2010) stated that in Nigeria, as low as Nigeria Naira 12,000 (about 79 USD) could establish a cellular phone business that provides employment and livelihood.
3. **Cellular Phone Usage in the Health Sector:** According to Micheal (2009, p.103) "that individuals around the world are using mobile technologies to access health services and information and that the professionals are formally and informally integrating mobile technologies into public health and clinical activities". Mobile health (mHealth) integrates into the wireless health care delivery systems. The use of ICT for Health (eHealth) has tremendously grown especially the use of cell

phones. In May 2008, 21.2% of the world's population used the Internet, which constituted 5.3% in Africa, 14.0 % in Asia, 23.8 % in Latin America, and 73.4 % in North America. The eHealth has influenced in the remote setting likewise to individual members of the public and the health sectors. In addition, mHealth raised the communication level in both the illiterate and literate population. Thus, it provides methods of information transferred through text messaging and pre-recorded voice messages. These methods transfer information quickly and can be used for tasks such as medication reminders of appointment dates. Meanwhile, mobile communication and health-related software applications aid decentralized health systems, give real-time feedback and provide pre-programmed automated services (Mecheal, 2009).

Challenges of GSM development in Nigeria.

The development of GSM in Nigeria and even other parts of the world had faced and is still been faced with lots of challenges. These challenges in one way or the other affect the quality of service rendered to customers by Internet service providers. They affect the quality (network and customer service quality) as much as they affect converge, which are critical success factors and the least common denominators of cellular operation anywhere in the world.

There are several challenges facing the GSM sub-sector in Nigeria. One of these is the need to extend mobile coverage to every nook and cranny of Nigeria. At present, mobile coverage is yet to be extended to 40 percent of Nigeria geographical spread. Thismeans that people in those areas cannot benefit from the effects of mobile telephony. It should be noted that most of the uncovered areas are the rural parts of the country where about 70 percent of the inhabitants dwell(Adeyinka *et al*., 2009).

The biggest challenge facing the mobile industry in Nigeria is Energy especially the issue of electric power supply. As of today, the companies within the industry generate their power through standby generators located in each of their base stations. This is considered outrageous and makes the whole operations and services very expensive. Other challenges include poor telecommunication infrastructure and inadequate skilled manpower. Most of the customers" expectations like cheaper Call rates are also challenging to the industry.

In addition to the very limited power supply is the poor mobile network coverage across many parts of Nigeria. Intermittent mobile network from the providers contributes to the high discharge rate of mobile phones since subscribers often have to keep trying a line for several times before they get connected (Henry et al., 2012).

Another factor is multiple taxations, by the government on service providers. However, this is not peculiar to mobile communication operators only or telecommunications companies, as one can remember over the issue of multiplicity of taxes charged by the Federal, State, and Local Government, for example, operators are made to pay certain amounts per meter of their masts located in various parts of the country. At times, once your facilities are in place, the host communities will begin to inundate you with letters demanding such infrastructure as roads, electricity, schools, hospitals, etc.

Other challenges include the twin problem of high foreign exchange and interest rates, charged by the government. However, this is not peculiar to mobile service operators but considering the volume of imported content of their operations, the impact is certainly more significant (Sadiq *et al*., 2011).

Conclusion and Recommendations

Communication is one of the integral parts of science that has always been a focal point for exchanging information among parties at locations physically apart. After its discovery, telephones have replaced telegrams and letters. Similarly, the term 'mobile' has completely revolutionized communication by opening up innovative applications that are limited to one's imagination. Today, mobile communication has become the backbone of society. All the mobile system technologies have improved the way of living. Its main plus point is that it has privileged a common mass of society (Krishn and Vinay, 2016). In this literature review, the evolution of mobile communications globally as well as the development of mobile communications in Nigeria, Its impact, and challenges are discussed.

References

Adegoke, A. S., Babalola, I. T., and Balogun, W. A. (2008). Performance Evaluation of GSM Mobile System in Nigeria, *Pacific Journal of Science and Technology*, *9*(2), 436-441.

Adeyinka Tella, Niran Adetoro, and Paul Adesola Adekunle. The European Journal for the Informatics Professional. A Case Study of the Global System of Mobile Communication(GSM) in Nigeria.Vol. X, April 2009.

Agrawal, J, Patel, R., Mor, P., Dubey, P., Keller, J., M. "Evolution of Mobile Communication Network: from 1G to 4G", International Journal of Multidisciplinary and Current Research, vol.3, no. 11/12, 2015.

Ajala. GIS and GSM network quality monitoring: A Nigeria Case study. Directions Magazine, 2005.

Ajiboye, J. O., Tella, A., Adu, E. O., and Wojuola, J. I. Stakeholders' Perceptions of the Impact of GSM on Nigeria Rural Economy: Implication for an Emerging Communication Industry, *Journal of Mobile Communications*, *3*(1), 1-7. 2007.

Bae E.H., Kim I.J., Ma S.K., Lee J.U and Kim S.W. Altered regulation of renal nitric oxide and atrial natriuretic peptide systems in lipopolysaccharide-induced kidney injury. Korean Journal of Physiology & Pharma-cology; 15, 273-277. 2011.

E. Ndukwe, telecommunications challenges for Nigeria in the 21st century, retrieved from: http://ncc.gov.ng/archive/speeches_presentations/EVC%27s%20Presentation/nici_programme VCspeech.pdf.

Goldsmith, A. *Wireless Communications*, Cambridge University Press.(2005).

Guangyi Liu and Dajie Jiang; 5G: Vision and Requirements for Mobile Communication System towards Year 2020; Chinese Journal of Engineering Volume 2016, Article ID 5974586

Henry V. Doctor, PhD,Alabi Olatunji, MSc, and Abdul'AzeezJumare. Bridging the Communication Gap: Successes and Challenges of Mobile Phone Technology in a Health and Demographic Surveillance System in Northern Nigeria. PGD Comp Sci., 2012.

Krishn K.G and Vinay K.S. Evolution of Modern Communication Systems. International Journal of Advanced Research in Computer and Communication Engineering; Vol. 5, Issue 6. 2016.

Kumar A., Liu Y., Sengupta J., Divya. "Evolution of mobile wireless communication networks 1G to 4G", International Journal of Electronics and Communication Technology, IJECT, Vol. 1, Issue 1, no. 12. 2010.

Kumaravel K. "Comparative Study of 3G and 4G in Mobile Technology", International Journal of Computer Science. 2011.

Manar Mohaisen, YuPeng Wang, KyungHi Chang. The Graduate School of Information Technology and Telecommunications, INHA University. 2009.

Meenal G. Kachhavay and Ajay P.T. "5G Technology-Evolution and Revolution" International Journal of Computer Science and Mobile Computing, Vol.3, no. 3. 2014.

NOKIA. Introduction to GSM Training Document, TC Finland, 1-9. 2002.

Panagiota D. Giotopoulou, The evolution of mobile communications: Moving from 1G to 5G, and from human-to-human to machine-to-machine communications, National and Kapodistrian University of Athens, School of Science. 2015.

Payal, Dhruv B., Kumar P. " A Research based study on evolution of cellular generations(5G)," International Journal of Advanced Research in Computer and Communication Engineering, Issue 7, no. 7. 2014.

R. Pandya, Mobile, and Personal Communication Systems and Services, 4th ed. New Delhi: PHI, 2004.

Redl, S. M., Weber, M. K., and Oliphant, M. W. *Introduction to GSM*, The Artech House Mobile Communication Series, USA. 1995.

Reinhardt Andy," A Telecom Show's No.:Gloom". Businesses February 22, 2005.

Sadiq O.M., Oyelade A.O. and Ukchukwu C.A.S. 10 years of Telecommunication Development in Nigeria. International Conference on Innovation in Engineering and Technology. IET pp 67-71. 2011.

Sucheta and Yadav K. P. "A Comparative Study of 1G, 2G, 3G and 4G" International Journal of Advances in Engineering Research, Vol.No.3, no. 3. 2013.
Swaroop Gandewar*et al*: 5G:wwww; International Journal of Advanced Engineering, Management, and Science; 2017.
T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd ed. Singapore: Pearson Education, Inc., 2002.
W. C. Lee, Mobile Communications Engineering, 2nd ed. New Delhi: Tata McGraw-Hill, 2008.