

The Growth and Impact of Information and Communication Technologies in Africa

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Abstract—This paper evaluates the rate at which Nigerians use the internet and impact of the internet in their daily activities. The study was carried out using survey research methodology. The primary data obtained were analysed using different statistical tools. The analysis of our data showed that Nigerians use the internet at different rate. Also, the study revealed that, preponderance respondents and internet users are students. Furthermore, it was found that there is notable increase in internet usage in Nigeria every year due to the introduction of internet enabled mobile phones, iPods and portable laptops. The study finally revealed that the penetration rate of the internet into Nigerian is linearly increasing over the years.

Index Terms—Internet, file transfer protocol, telnet, World Wide Web, e-mail

I. INTRODUCTION

Over a century ago, the desires to have the right information at the right time have spawned the development of a host of innovative wireless services and applications. The first step toward shattering the barriers of space and time in information dissemination was the invention of telephone in the 19th century. The second step toward having the right information at the right time and at right place was the successful deployment of radio or wireless communications. With each passing day, as the world is becoming increasingly information dependent, one of the new innovative wireless services that enhance space and timely access to information is the internet. The internet, which is also known as the 'Net', according to [1] is a global system of interconnected computer networks that use the standardized Internet Protocol (IP) Suite. The author simply defined internet as the network of networks that consists of millions of privates and public, academic, business, and government networks of local to global scope that are linked by copper wires, fibre-optic cables, wireless connections, and other technologies. Hence, internet can be referred to as an information carriage using standard IP and different computer networks. This invention of internet was indeed a successful step toward timely dissemination of information among peoples of the world. This is evidence with the advent of the World Wide Web (WWW) and electronic mail (e-mail) which internet provides that have

opened up new vistas in peoples' day to day lives as well as reducing the whole world to a global village.

The rest of the paper is as follows. In the next section, literature review of ICT in Nigeria and brief information on some internet services were presented. Detailed information on the methodology used in carrying out this study was presented in the third section of the paper. The data obtained as well as results on analysis were presented in the fourth section using table, graph and pie chart. In the fifth section of the paper discussions on the results were presented. The paper was finally concluded with recommendations and conclusion in the sixth section, which is the last section of the paper.

II. LITERATURE REVIEW

According to [2], the idea of internet was initially conceived by the United State Department of Defense in 1969. It was called Advanced Research Projects Agency Network (ARPANet). The aim of ARPANet was to create a network that would allow researchers to communicate from different universities. However, with the advancements in Information and Communication Technologies (ICT), the internet has become a means of transferring information to billions of peoples worldwide. People nowadays depend on internet as a feasible means of communicating and transacting by using different applications and files of diverse categories [3]. For instance, as reported by [4], e-mail, which is one of the applications provided by the internet, has dramatically reduced the rate of patronage of the postal services worldwide. Similarly, internet has enabled live chatting and real-time voice conversations and broadcasting (audio and video streaming) with the advancement in digital signal processing. In addition, according to [5], real-time images or video, also known as web cam, is now possible through the Net. Additionally, varieties of applications and services that internet supported such as e-commerce, e-government, e-banking, e-business, e-learning and virtual library has made internet the most prominent tool for information dissemination worldwide.

Unlike other parts of the world, Africa was the last known continent to embrace ICT such as the internet in the world [6]. This is illustrated in Fig. 1 while Fig. 2 shows Africa internet usage profile compared with the

rest of the world. This marginal internet usage profile for Africa was stemmed from the fact that only a very limited number of Africa nations had local internet access. However, recent assessment of internet penetration in Africa, as shown in Fig. 3 and Table I, shows that internet penetration is on the increase in Africa [7], [8]. This is a result of recent discovery of the benefits of ICT in both economic growth and poverty reduction. For instance as reported by [9], twenty-five Africa nations achieved a Gross Domestic Product (GDP) growth rate above 5% in 2007 while another fourteen Africa nations GDP grew at a rate between 3% and 5% as a result of ICT.

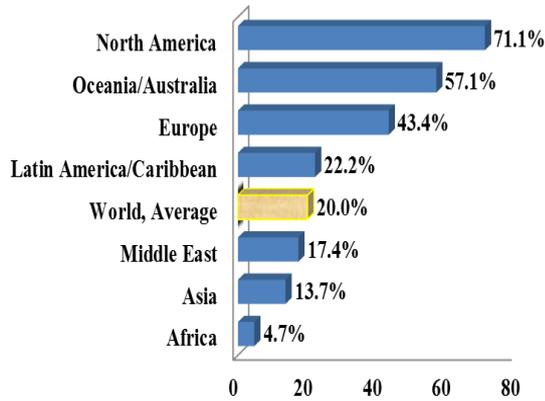


Figure 1. World Internet penetration rates as at December 2007 (Adapted from [9]).

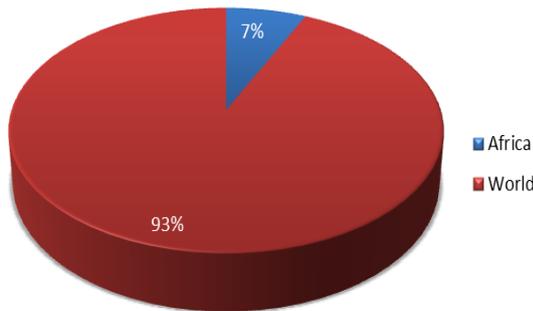


Figure 2. Internet users in Africa and world as at December 2012 (Adapted from IWS [7]).

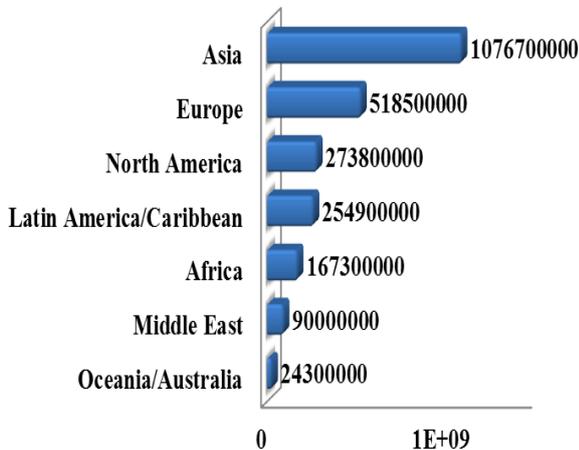


Figure 3. Internet users in the world as at December 2012 (Adapted from IWS [7]).

TABLE I. WORLD INTERNET USERS AS PERCENTAGE OF THE TOTAL POPULATION (ADAPTED FROM [8])

Region	1998	2000
United States	26.3	54.3
High-income OECD (excluding USA)	6.9	28.2
Latin America and the Caribbean	0.8	3.2
East Asia and the Pacific	0.5	2.3
Eastern Europe and CIS	0.8	3.9
Arab States	0.2	0.6
Sub-Saharan Africa	0.1	0.4
South Asia	0.04	0.4

In Nigeria, similar trend in internet usage and growth rate observed in Africa was experienced. As illustrated in Fig. 4, Nigeria was the second top internet usage nation in Africa as at June 2009 [6]. However, recent assessment of internet usage in the continent, as shown in Fig. 5, shows that Nigeria has become the first top Africa nation using the internet in the continent.

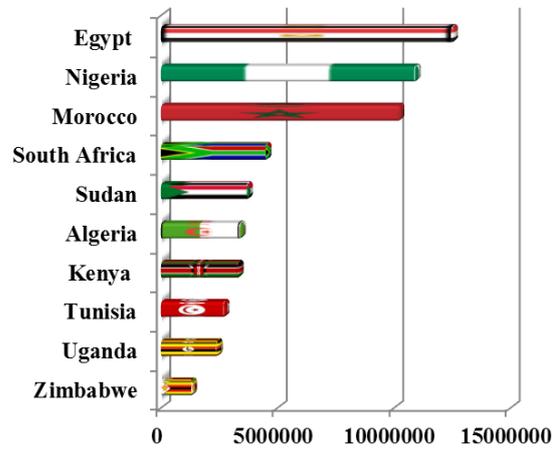


Figure 4. Africa Top 10 internet Countries as at fourth Quarter of 2009 (Adapted from [6]).

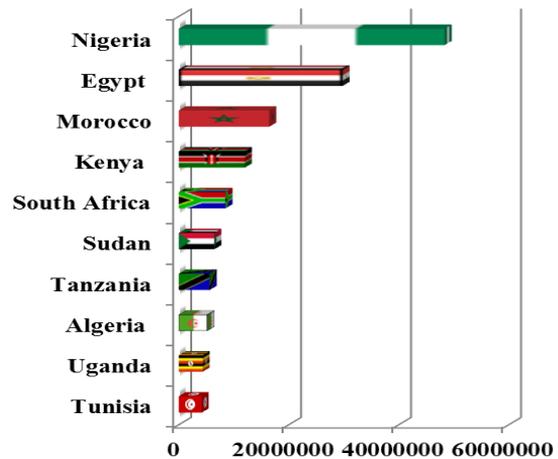


Figure 5. Africa Top 10 internet Countries as at fourth Quarter of 2012 (Adapted from IWS [7]).

Although Nigeria is currently the first country in Africa with the highest internet users, the various working folks using the internet in Nigeria has not really been determined. The purpose of this paper therefore, is to investigate the growth rate of internet as well as

different categories of internet user in Africa using Nigeria as a case study. The study was carried out using survey research approach. This methodology was adopted because, as reported by [10], it is the current best acclaimed method of collecting original data from a large population of respondents at lowest cost. Also, the survey research strategy was employed in this study because it is a widely used and an acknowledged research method when considering data or information derived from a small number of people to be an accurate representation of a significant larger number of people [10].

A. *ICT in Nigeria*

In Nigeria, different means of disseminating information in the past comprises of graphical symbols, smoke signals, postal services, public switched telecommunication network and telegrams. These were followed directly with ICT initiative in 1950s with focus on newspapers and electronic media namely radio and television (TV) broadcasting. These electronic media were initially owned, controlled and monopolized by the central or federal government. However, today, there are various radio and television stations in Nigeria owned and controlled by the state governments and private. Currently, there are also digital satellite televisions also known as cable TV using pre-paid services to stream contents to subscribers across Nigeria. The recent deployment of mobile or cell phone in the country has indeed accelerated the pace of information dissemination in Nigeria. Internet services availability on mobile phones also has enhanced both the rate of information dissemination and pace of economic development in Nigeria.

Internet was first introduced in Nigeria in early 1990s. However, the usage of internet only became popular in 1995 following an internet workshop organized by the Yaba College of Technology [11]. The use of internet as well as access to internet grew in 1999 as cybercafés sprang up in major cities across the country. Internet access was spurred further in 2004 with the introduction of internet access via mobile phones services. As reported by [11], there were about 100,000 internet users in Nigeria as at 1999. However, the figure jumped to 11 million in 2008 and reached 46 million in 2011. This increase in internet access and usage in Nigeria according to [11] is as a result of the increase in mobile-phone usage and data services over this period as well as private and government investment in technology, and increased competition among the Fixed Wireless Access (FWA) providers in the country.

Another factor contributing to increase in internet access and usage in Nigeria is the federal government establishment of Nigerian internet exchange point, which serves as a means of interconnecting various internet service providers (ISPs) in the country. Until recently, most businesses requiring high bandwidth services such as ISPs, banks and telecommunications companies in Nigeria did relied on satellite links and fibre-optic cable or SAT-3 undersea cable for their international internet connection [11]. However, when the SAT-3 cable encountered problems in July 2009, according to [11] as

much as 70 percent of the country's internet traffic was disconnected. But with the establishment of Nigerian internet exchange point as well as migration of several telecommunications companies to private fibre-optic cable project, such as Glo-1 and MainOne, such international internet disconnection had been eradicated.

Despite the successful establishment of Nigerian internet exchange point and the rapid increase in internet access and usage in Nigeria, observations show that the penetration rate of internet in Nigeria is only 30 percent of the Nigerian population [11]. Observations also show that access to internet is usually greater in urban areas than in the rural areas. One of the reasons for low internet penetration in Nigeria is cost, as the price for internet use usually ranges from N100.00 (about US\$1.00) per hour in cybercafés to an average of N1,000.00 (about US\$7.00) per megabyte of data on Global System for Mobile (GSM) network. Another noticeable factor is the current instability of electricity supply in the country.

B. *Some Internet Services*

The internet is one of the greatest discoveries of human being. Its development has changed every part of human life; such as information dissemination, entertainments, business transactions and knowledge acquisitions. Its invention, as mentioned earlier, has reduced the world to a global village, which has made information dissemination to scale beyond many geographic barriers with various applications. Some of these applications or services are electronic mail, the World Wide Web, telnet, remote access, file transfer and multimedia chat. Brief explanations of these services are presented in the following sub-sections before providing detailed information on the methodology employed in carrying out this study.

1) *World Wide Web*

The WWW is a well-known and used subdivision of the internet. The information in WWW is distributed in hypertext format and browser allows us to read the information. The WWW application is a user friendly because hyperlinked information constitutes information resources that are linked to other information resources [2]. The resources on www are text, images, software, audio, and movies [3].

2) *Electronic Mail*

Electronic mail (e-mail) is the most popular communication method on the internet ever known to man [2]. It is the transmission of electronic messages over networks from a user that is connected to the internet to another without geographical limitations. The application also supports attachment of pictures, documents, audio and movie files. Compared to the typical postal services and fax, e-mail offers the cheapest and fastest method of communication [3]. Furthermore, e-mail is the most widely used communication tool on the internet because of free services offered by internet Service Providers (ISPs) like Gmail, Hotmail and Yahoo [2].

3) *Internet Relay Chat and Web Chatting*

Internet Relay Chat (IRC) is a means of having virtual conversation with people on different topics in real-time.

In IRC, conversations take place in channels, and to participate in conversation, a channel has to be joined. Furthermore, unlike IRC, web chatting uses browser to enable participation in conversations conducted in web chat rooms [2].

4) *File Transfer Protocol (FTP)*

The File Transfer Protocol (FTP) is a protocol that gives reliable uploading and downloading of information on the internet. Different free softwares and information are available on the internet on FTP servers for downloads [3]. Unlike the Trivial File Transfer Protocol (TFTP) that is used for unreliable communications, FTP is used for reliable communication systems [2].

5) *Telnet*

The Telnet protocol is an application that allows remote connection to another computer host. The Telnet program enables connection to a server on the network. The user can then log in so as to have access to resources on the remote server. This service is always used by network administrators to configure remote network devices [2].

III. STUDY METHODOLOGY

This study was carried out in Akure, the Ondo State capital. Akure is on latitude 7° 16' 48" North and longitude 5° 14' 41" East in South West zone of Nigeria. The city was used because it has all the features of all categories of internet users in Nigeria and Africa as a whole. In carrying out the study, questionnaires were used to solicit for data from the various categories of internet users in the city. 45,000 questionnaires were distributed and some were sent as an attachment via e-mail to respondents locally and internationally. A total of 42,100 answered questionnaires were received for further analysis. This represents 93.56 % response rate. Out of the received responses 800 people claimed that they had never used the internet. The study was based on the remaining 41,300 questionnaires. Data gathered from the investigation comprised: Year of using the Net, Categories of internet users and the Nature of Services sought for on the internet. Data collected was analysed using Statistical Package for the Social Sciences (SPSS) 20.0 and Microsoft Excel 2010 packages.

IV. RESULTS

A. *Year of Using the Net*

In the survey questionnaires, the respondents were asked to indicate how long they have been using the internet. The obtained data are presented in Table II. The table shows years, number of users per year and percentage increase in internet usage by the respondents. From Table II, it was observed that there was notable increase in internet usage around 2005 and there was high penetration around 2007. Furthermore, the obtained data was presented graphically in Fig. 6, showing the relationship between the numbers of internet users over the years. As shown in Fig. 6, it is observed that internet usage in Nigeria is growing linearly over the years.

TABLE II. INTERNET GROWTH BETWEEN 2000 AND 2012

Year	Frequency	Percent	Valid Percent	Cumulative Percent
2001	100	.2	.2	.2
2002	200	.5	.5	.7
2003	400	1.0	1.0	1.7
2004	700	1.7	1.7	3.4
2005	1100	2.7	2.7	6.1
2006	1800	4.4	4.4	10.4
2007	2500	6.1	6.1	16.5
2008	3500	8.5	8.5	24.9
2009	4700	11.4	11.4	36.3
2010	6500	15.7	15.7	52.1
2011	8600	20.8	20.8	72.9
2012	11200	27.1	27.1	100.0
Total	41300	100.0	100.0	

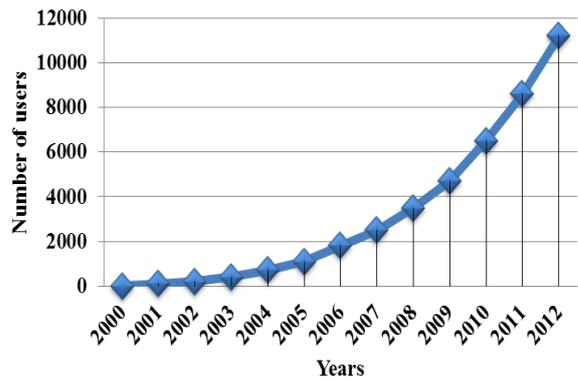


Figure 6. Internet usage against number of users between 2000 and 2012.

B. *Categories of Internet Users*

Responses on categories of internet users were presented in Table III, which shows that students use the internet more than any other users while others i.e. small and medium enterprises represent the smallest category of internet users. The categories of Nigerians using the internet for private uses and public works fall in between these two limits with private users higher than the public users. In addition, the respondents were asked to specify what they use the internet to do, such as entertainment, educational, research, business transactions, information gathering, chatting and e-mailing. The responses obtained were used to specify the impact of the internet in Nigeria. The responses obtained on different services the respondents sought for on the internet are presented graphically in Fig. 7, which shows how frequent respondents use the services and overall percentage of their respective internet usage.

TABLE III. INTERNET GROWTH BETWEEN 2000 AND 2012

Employment Categories	Frequency	Percent	Valid Percent	Cumulative Percent
Student	21600	52.3	52.3	52.3
Public	8300	20.1	20.1	72.4
Private	9500	23.0	23.0	95.4
Others	1900	4.6	4.6	100.0
Total	41300	100.0	100.0	

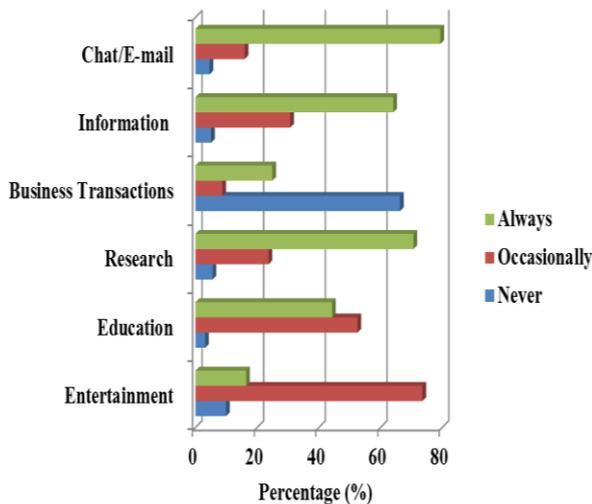


Figure 7. Frequency of Internet services usage

V. DISCUSSIONS

A. Entertainment

The internet provides lots of entertainment facilities such as sports, free games, streamed audio and videos, which are being explored by Nigerians [12]. For instance, some Nigerians that are lovers of football depend on such entertainment sites for checking results of football matches. Other listen to music, watch video and other entertainment shows on internet. Some also download free local and foreign films and music through the Net. Furthermore, some radio and television stations in Nigeria have their signal streamed so that people can monitor them at anytime and anywhere. Besides, Nigerians use internet to book flight and make hotel reservations. As shown in Fig. 7, the result of this study shows that majority of the respondents (73.61%) use the internet occasionally for entertainment, 16.46% always use the internet for entertainment while 9.93% never use the Net for entertainment purposes.

B. Educational Purposes

The internet or simply the Net has various applications for educational purposes. It provides learning platforms such as Virtual Classrooms, Webcasting and online educational videos [5]. Moreover, Nigerians do use the Net to search for international scholarships as well as to secure admission overseas. Also, some Nigerian universities with well-developed websites where students can register online, download study materials and check their results for the semester, use the internet for educational purposes. These uses buttress [13] and [14] observed impacts of internet in Nigeria educational sector. Actually, never before in human history before the invention of the internet did such a valuable resource been available to students at little or no cost. The analysis of our obtained data on educational purposes presented also in Fig. 7, shows that, preponderance respondents (52.54%) occasionally use the internet for educational purposes, 44.31% of the respondents use the Net

regularly for educational purposes while only 3.15% representing the lowest percentage that had never use the Net for educational purposes.

C. Research

In Nigeria, both working class and students use the internet for research purposes. There are certain research institutes in Nigeria that have 24 hours connection to the Net. Furthermore, tertiary institution students across the country like other parts of the world do depend on the Net to get information for their projects [13], [15]. In addition, some students have online groups where they discuss and solve academic related matters. This study result, as shown in Fig. 7, revealed that 70.70% of the respondents always use the Net for research purposes. Similarly, the study also revealed that 23.73% of our respondents occasionally use the internet for research purposes while only 5.57% claimed never to have used it for research purposes.

D. Business Transaction

The internet provides Nigerians the convenience of shopping anytime and anywhere. Through the internet, Nigerians have better access to information and wider selection of goods and services. Prices can be compared online before making purchases. This has made internet the major tool uses by Nigerians to keep track of their financial trends, search for loans, check account balance, and perform other necessary financial tasks [16]. All Nigerian banks are connected to the Net and customers can withdraw at any part of the nation. Furthermore introduction of Automated Teller Machines (ATMs), enabled by the internet has eased banking operations. The result of our survey, as shown in Fig. 7, shows that 66.34% of the respondents never use the Net for business transaction, 24.94% always use it for business transactions while 8.72% occasionally use it for business transactions.

E. Information

The internet leverages our ability to find, manage, and share information. The Net is an essential medium from which Nigerians search for the latest information around the world. Live news and other information are accessible through the Net. Also, Nigerians depend partially on the Net to read both local and foreign newspapers [12]. Furthermore, majority of the media houses depend on the internet to get latest information so as not to broadcast stale news to their audiences. Even some newspaper companies in Nigeria are currently using the internet to transfer the news to be printed from their headquarters to the remote branches so that the paper can be printed there so as to save time and transportation cost. With these impacts in mind, our survey question was designed to get responders usage of the internet in obtaining up-to-day information. This result of our survey, as shown in Fig. 7, shows that 64.16% of our responders always use the internet for gathering information, 30.75% occasionally use the internet while the remaining 5.08% claimed never to have used the internet for gathering information.

F. Chatting and E-mail

The internet access has become an integral part of Nigerians' lives. It is currently the new medium of communicating with families and friends across the world. With the introduction of internet enabled mobile phones and iPods, Nigerians can now chat at anywhere and anytime [12], [17]. As a matter of fact, majority of students equally use the internet through chatting and e-mail application for online dating. The result of our study presented graphically in Fig. 7 reveals that 79.42% of the Nigerians always use the Net for chatting and e-mail. Similarly, as shown in Fig. 7, 15.98% of our responders indicated that they occasionally use the internet for chatting and e-mail while 4.60% indicated they had never use the internet for chatting and e-mail.

In assessing the overall impacts and usages of internet in Nigeria, the different services Nigerians use the internet for were compared. The results of these services are presented in Fig. 8. The comparison reveals that majority of the respondents used the internet for chatting and e-mail while minority used it for entertainment purposes. The comparison also shows the various applications in the internet are used at different rate.

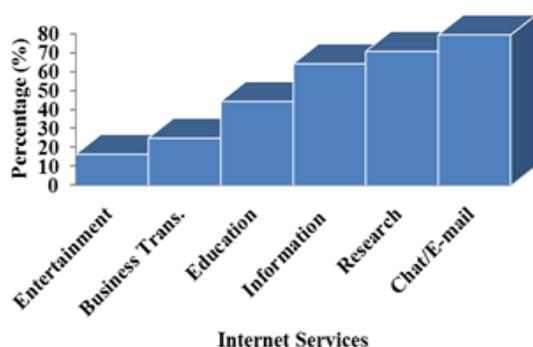


Figure 8. Frequency of services that are always in use on the internet

VI. CONCLUSION AND RECOMMENDATION

The internet has really changed everything in Nigerian, African and the rest of the world. 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.

In addition, this study also reveals that the utilization of the internet in Nigeria can be improved so that maximum benefit can be derived from the internet. This

can be achieved by integration of ICT into the mainstream of education and training in Nigeria. Additionally, internet training should be organized by various employers for their members of staff so as to create cognizance of the significance of the internet. Also, it is recommended that government intervention to provide subsidized high speed broadband infrastructure is essential in transforming Nigeria economy into world-class standard. Furthermore, government at all levels should ensure that there is uninterrupted power supply so that the internet infrastructure can be properly utilized.

Based on the foreseen opportunities attached to these suggestions, we therefore recommend that the government at all levels in Nigeria should see to the fulfilment of these recommendations. This is because if the above suggestions can be observed and put into practice, it will not only enhance the internet usage and impact in Nigeria, but will indeed increase the standard of living of Nigerians. Also, if the suggestions can be observed, we believe it will not only enhance the quality of both the graduates and researches in Nigeria universities but will equally contribute to the socio-economic development of Nigerians, Africans and the whole world at large.

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