THE ROLE OF POWER SUPPLY IN THE DEVELOPMENT AND SUSTAINING ICT-BASED BUSINESS SECTOR IN NIGERIA: AN EMPIRICAL EVIDENCE OF NORTHERN NIGERIA

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Abstract
The study examines and provides empirical overview of the role of power in the development and sustenance of ICT- based business outfits in Northern Nigeria. Providing consistence and regular power supply in Nigeria for the development of infrastructures and business is full of challenges thus current national debate has attracted Authors, Researchers and Scholars from different field of endeavours to extrapolate the causes and to proffer solutions to this effect. The expedients/main focus of this paper is to assess the role of power supply for the development and sustain ability of ICT based business sector in Northern Nigeria. Methodologies used for data collection consists of a field work and questionnaire administration. The two instruments were concurrently applied across some selected Northern Nigeria states. 200 copies of questionnaire were administered to respondents. Stratified Random Sampling Technique was employed to select respondents. Data where analysed based on descriptive data analysis, where each respondent was weighed against responses from respondents using 4 likest scale system of grand point and grade mean to summarised data. Deductions show the adverse effects of poor power supply on ICT based business, is on the increase, further compounded by the current security insurgency in the study area. No much suitable attention is paid to improve power supply, despite the large amount of money Sunk in proving adequate power supply in Nigeria Government. Incentives and disbursement of funds can play an important role in improving power supply to sustain the emerging ICT- based business sector in Northern Nigeria. The study concludes with a design recommendation that can address the key findings.

Keywords: *Power Supply, Role, ICT-based Business, Assess, development, Sustainability.*

Introduction

Power (Electricity) is central to any economic development. The industries and factories require stable and uninterrupted power supply to function. Without power, even small and medium scale enterprises will be strangulated. With power, quality life will be visited on the populace because there will be new way of doing almost everything; learning, manufacturing, cooking, washing etc. The industrialized world is accepted so, because electrical power is readily available for research, experiment and production.

In particular, electric delivery is one of the oldest technologies on earth (Encyclopaedia Britannica 2004 and The Guardian 2009). It was a major part of the industrial age which is about a century and a half old. The technology has been patent, routinized, made easily available and accessible to mass consumer all over the world, (The Guardian 2009). It could be described as the central nervous system of modern societies

and modern living, (Akparanta 2009, Oredipe and Bakare, 2009), but the near comatose state of the Nigerian electricity sector is perhaps the greatest developmental drawback facing the nation owing to the diverse use of electricity in practically every aspect of life (Ogunmade 2008, Odeyinka 2009, and Odumosu and Aderogba 2008; Oredipe and Bakare, 2009).

Nigeria's power supply problems have had a devastating effect on business in recent years. Due to the lack of electricity, most businesses have to rely on generators, which are very expensive to run. This has forced many companies to close shop because they could no longer remain competitive. President Umaru Yar'Adua – who, due to illness, has recently temporarily handed over the reins to his deputy, Goodluck Jonathan – promised the Nigerian public that the country would be delivering 6,000 megawatts (MW) by the end of 2009. This has not materialized and Nigeria currently has to make do with around 3 000 MW.

In 2004 the government implemented the National Integrated Power Project (NIPP) with a goal of building new generating plants; numerous transmission and distribution projects as well as gas pipelines and other related equipment infrastructure. These projects have, however, been held back by various challenges and few are on schedule. One of the major reasons for the poor state of Nigeria's power sector is that there is not enough gas available to run gas-powered plants. The gas that is supposed to run these power stations is being exported, and Nigeria is tied into multi-year contracts to supply gas to international companies. When gas is available for domestic consumption, it often doesn't get to its intended destination because of theft or negligence. This situation has been worsened by the fact that militants in the Niger Delta have blown up many of the gas pipelines.

Another problem is Nigeria's poor transmission and distribution networks. Transmission lines are poorly maintained and frequently vandalized-resulting in transmission losses of over 25% of electricity produced. To add to the troubles, local communities have been thwarting work to construct new electricity transmission and distribution infrastructure. Power supply is a device that supplies electric power to an electric load (Wikipedia, 2013). According to Abbas (2008), sustainable development refers to a development that caters for the need of the present, without compromising the need of the future generation. While Information and Communication Technology, usually called ICT, an acronym that emerges from Information Technology, in September 2000, as supported by www.webpodia/IT.com. It is a more general term that stresses the role of Unified Communications and the Integration of Telecommunications (Telephone Lines and wireless signals), intelligent building management system and audio-visual systems in Modern Information Technology, ICT consists of all technical means used to handle information and aid communication including Computers and Network Hardware, Communication Middleware as well as necessary software. The term ICT is now also used to refer to the emerging (convergence) of Audio-visual and Telephone Networks through a Single Cabling or Link System (Web podia 2005) in (Mejabi and Ati 2011).

There are large economic incentives (huge cost savings due to elimination of the telephone network) to emerge the Audio–visual, Building Management and Telephone Network System with the Computer Network System using a single unified system of Cabling, Signal Distribution and Management. This in turn has spurred the growth of organizations with the term ICT in their names to indicate their specialization in the process of merging the different networks. There is no denying the fact that the nexus between these variables is that the potent impact of power supply both has positive and negative effects on ICT-Based business sector in Nigeria Ecological Zones and on Telecommunication Infrastructures,

conspicuously in most states of Northern Nigeria. The aim of this paper is to assess the role of power Supply in the Development and Sustaining ICT-Based Business Sector in northern Nigeria: with the following Objectives:

i. Examine the impact of power supply on Telecommunication infrastructures in northern Nigeria.
ii. To assess the impact of power supply on ICT–based businesses in northern Nigeria.
iii. To asses government and non-governmental participation in electric power generation and supply.
iv. To appraise the emerging evidence of the manifestation of positive effects of power supply on Telecommunication in northern Nigeria.

The Area Of Study

Northern Nigeria is a geographical region of Nigeria. It occupies about two-third land mass of Nigeria. The region includes Kaduna, Katsina,Kano,at the North west. ,Kogi ,Kwara, Benue and Taraba States towards the southern axis of the Northern Region. The people are largely Muslims, and many are Hausa Speaking. Much of the north was once politically united in the Northern Region, a federal division disbanded in 1967. Hausa and Fulani makes up the Dominant Tribes. The area in focus covers approximately 60% of the Nigeria's land area. It is confined within latitudes 60 37' North - 130 40' North and longitudes 30 40' - 130 37' East (Times Atlas). It has a population of 73,637,065 people, excluding the Federal Capital Territory (Nigerian News, 2006) 48% of these numbers are women. Most parts of the area lies within the northern limits of rain bearing winds, with a high variability of rainfall in time and space. The semi and arid zones known as ultimate Savannas encompass the Sudano-Sahelian vegetation belt of West Africa (Abul et al, (2000) and Mike et al (1999). The predominant vegetation consists of grass and forbs. Evapo-transpiration rates are high and often exceed precipitation averages. Most water points dry up due to high evaporation rates and infiltration on sandy surfaces. The low relative humidity experienced in dry season is a product of dry, dusty and cold harmattan air. Temperatures can drop below 100C (November-February) in some nights and unbearably high (<330C) during the day (March-October) in clear skies, (Abdulkarim, 2003). In the North, Grasses are of economic Importance. During Wet Season, about 80 Percent of the Region's Population is engaged in Peasant Farming activities, producing both Food and Cash Crops, such as Cotton, Groundnut, Tobacco, Maize, Yam, Beans, Guinea Corns, Ginger, Rice, Cassava, Sugar cane. On land surface of the region, are located and sited Telecommunications and Information and Communication Technology Infrastructures and Super-structures. Examples of such Telecommunication Companies are: MTN, Airtel Globacom, Visafone, Multilinks, Telecom, Ntel, Etisalat, Multimedia, and Internet Service Providers. The hot spot for the study are Bauchi, Gombe, Jigawa, Kaduna, Kano, Katsina, Kebbi, Niger, Sokoto and Zamfara.

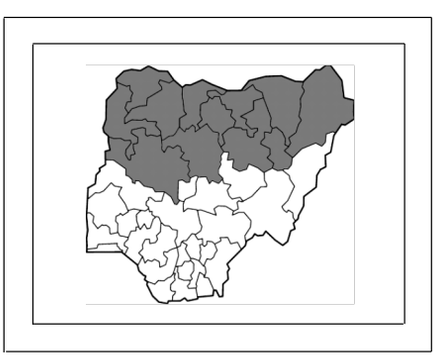

Fig. 1: The Map of the Study Area.
Source: Mejabi and Odjugo 2012.

Method And Materials

To achieve the objectives of the Research Paper, a combination of Field Work, Interview and the review of relevant Literatures were used for data acquisition. The data, on which this research is based on, were collected, through administered copies of questionnaire and Interview Method, which is the Primary Sources of data collected between May and July 2013. Simple and Stratified Random Sampling Techniques was used to select some Telecommunication and ICT Companies, Internet Service Providers, Multimedia Companies, Academia and Professionals, in 10 northern States of Nigeria. A total Number of 200 questionnaires were distributed to Respondents; in the selected states, as:

Table 1: Distribution of Respondents, according to States in Northern Nigeria

S/NO.	STATES	NUMBER OF COPIES OF QUESTIONNAIRE	PERCENTAGE (%)
1.	Bauchi	20	10
2.	Gombe	15	7.5
3	Jigawa	20	10
4.	Kaduna	30	15
5.	Kano	25	12.5
6.	Katsina	20	10
7.	Kebbi	15	7.5
8.	Niger	20	10
9.	Sokoto	20	10
10.	Zamfara	15	7.5
	Total	**200**	**100**

From the table above, Kaduna and Kano states have the highest numbers of copies of questionnaire administered (15% and 12.5%). This is because these are States where most of these telecoms infrastructures are located. While Kebbi State, amongst the ten selected northern States, has the lowest number of telecoms infrastructures (7.5%).

Result and Discussion

The Information gathered and collated from Respondents, was Computed, Manipulated, and Analyzed and statically presented to reveal the responses from the use of Influential Statistics, applying Four Likert Scale System of Strongly Agree (SA), Disagree (DA) and Strongly Disagree (DA) and Strongly Disagree (SDA) and Grand Mean (x) to summarize the responses.

Formula for computation and analysis:
F/N*100/1=,
Where F= stand for Frequency and Total Number of Returned Questionnaires.
% = Percentage
N= Number of Respondents.
Grade point: SA=4, A=3, DA=2 and SDA=1.
The results of the analysis are represented and discussed under the following headings:

Table 2: Distribution of Respondent in the Telecommunication/ICT Companies, Professionals, Lecturers and the Community.

S/NO.	PROFESSION	NO OF RESPONDENT	PERCENTAGE (%)
1.	Telecommunication/ICT Companies.	4O	21.05
2.	ICT, Multimedia and Internet Providers.	30	15.80
3.	ICT and Computer Accessories Vendors, Recharge Card Retailers.	40	21.05
4	Telecommunication/ICT Consultants and Academia.	40	21.05
5.	Community	40	21.05
	Total	**190**	**100**

From table 2 above, a total of 200 Questionnaires where administered to respondents, only, 190 Questionnaires were returned. Analysis shows that Telecommunication/ICT and related Companies accounts for 57.9%, Professional and Academia 21.05% and the Community was 21.05%, makes up the total of 100%.

Sample 1: To what extent does Respondents understands the Concept and Impact of Power Supply on Telecommunication/ICT Businesses in northern Nigeria.

Table 3: Mean Response to how Respondents understood the Concept and Impact of Power Supply on Telecommunication Infrastructures and Businesses.

S/NO.	ITEM	SA	A	DA	SDA	NA	MEAN (X)	REMARK
1.	Respondents understood the Concept of Power Supply and ICT Business.	130	40	12	8	190	3.54	Strongly Agreed
2.	Respondents understood the impact of Power Supply and ICT Business in northern Nigeria.	139	31	8	12	190	3.56	Strongly Agreed
3.	Failure in Power Supply has led to Obstruction in the propagation and Fading of Electromagnetic and Radio Waves Signals during Communication via Telephony or Mobile Devices in most part of northern Nigeria.	130	40	12	8	190	3.54	Strongly Agreed
4.	Electric power surges have caused serous damages to Telecommunication and ICT Infrastructures/equipment on Land Surfaces in northern State of Nigeria.	95	60	20	15	190	3.24	Agreed
5.	Electric power fluctuation ofte n leads to loss of data and information.	66	76	30	18	190	3.00	Agreed
6.	Impact of power supply on Telecommunication/ICT businesses has started having adverse and cascading effects on northern Nigeria's economy status.	139	31	8	12	190	3.56	Strongly Agreed
7.	The economies of Northern Nigerian populace stand the chance to suffer as a result of direct effects of poor Power Supply on Telecommunication/ICT infrastructures and businesses.	77	60	29	24	190	3.00	Agreed

Source: Researchers' Field Work (2013).

Grand mean= $\frac{\sum(X)}{N}$

Where $\sum(X)$ = Summation of Number of Means.
N = Number of Variables.

Grand Mean= $\frac{\sum(X)}{N} = \frac{23.44}{7} = 3.35$.

Table 3, above having Item 1 to 7 on the Questionnaire with responses of 1 to 7, from Respondents, as analyzed shows that Item 1, 2, 4, 5 and 7 were rated 'Agreed' with Means of 3.24, 3.00, and 3.00, while Item 1, 2, 3 and 6 are rated 'Strongly Agreed' with Means of 3.54, 3.56, 3.54, and 3.56. The Cumulative Mean for this Sample is 3.35, thereby supporting the fact, that more than average of the Respondents in northern Nigeria has an idea of the Subject Matter. It is evidence that the impact of power supply has started to be felt strongly on the northern Nigeria's economic environment and on its telecommunication infrastructures, conspicuously in the loss of electronic data and damage of ICT-based devices. Items, shows that impact of power supply on Telecommunication, were evident via Poor Signal Receptions, when making or receiving Calls from Mobile Phone. Furthermore, analysis has proven that, with poor power supply on Telecommunication/ICT businesses there will be a continuous cascading and retrogressive effect on state of the Nigeria's economy, particularly, northern Nigeria, since Nigeria as a nation, has seen the expediency of Telecommunication and ICT art as an avenue towards improving Business Transactions and political administration. A threat by from power supply at the height of an emergency could have devastating toll on the nation's economy.

Sample 2: How will Power Supply affects Telecommunication/ICT Business Sector of northern Nigeria

Table 4: Mean Response to the implication of Stable Power Supply on telecommunications/ICT Businesses for Sustainable Development in northern Nigeria.

S/NO.	ITEM	SA	A	DA	SDA	NA	MEAN (X)	REMARK
8.	Adequate power supply can be used to revive the failing Nigerian economy.	110	40	17	23	190	3.25	Agreed
9	Stable power supply on Telecommunication/ICT can help Nigeria achieved its vision 20:20:20 and MDGs goals.	129	38	13	10	190	3.51	Strongly Agreed
10.	The Nigerian Telecommunication/ICT business sector, if properly harnessed, will create large scale employment for Nigerian citizenry, particularly of northern extract.	115	64	5	6	190	3.52	Strongly Agreed
11.	Adequate power supply will enable quality working environment, increase industrial and consumable goods in markets and increase Productivity of Office Workers of northern Nigeria.	118	60	8	4	190	3.54	Strongly Agreed
12.	Telecommunication/ICT devices have been identified as a veritable tool to assist in promoting sales of goods and services in most Nigeria's markets for a sustainable development.	124	49	10	7	190	3.53	Strongly Agreed
13.	Consistent power supply to Telecommunication/ICT business environment can be a solution to the eradication of poverty status of northern States of Nigeria.	95	72	15	8	190	3.34	Agreed
14.	ICT Technologies have the potentials to help improve Nigerian economy and raise standard of living of northern Nigerians, through profit ploug h back for Re -Investment and Income and revenue generation of the northern Nigeria Populace.	126	48	12	4	190	3.56	Strongly Agreed

Source: Researchers' Field Work (2013).

Grand Mean= $\frac{\sum(X)}{N}$

Where $\sum(X)$ = Summation of Number of Means.

N = Number of Variables.

Grand Mean= $\frac{\sum(X)}{N} = \frac{24.25}{7} = 3.46$.

From the above table, Item 9, 10, 11 and 14 with Mean of 3.51, 3.52, 3.54 and 3.56 of the responses, rates 'Strongly Agreed', while Item 8 and 13 are rated 'Agreed' with Mean of 3.25 and 3.34, Grand Mean (x) of 3.46, analysis indicates, that adequate and consistent power supply will have positive impact on Telecommunication/ICT business sector of northern Nigeria. It has been observed that consistent power supply will revived the ailing Nigerian economy and to realize its vision 20:20:20 and Millennium Development Goals. Furthermore, ICT is considered a key agent for the increase of productivity and supply of goods and services in the northern Nigerian markets and in increasing the efficiency of Office Workers domiciled in northern Nigeria. Telecommunication and ICT has also been identified to as a means of creation sustainable jobs/employments, increasing income and revenue generation and in down-sizing the poverty status of the northern Nigerian States; this was attested to, by Respondents in the study areas. Analysis also shows that ICT can also eliminate the need for much travel through Advance Video Conferencing, Web-based Seminars, so called Intelligent Transport System, affecting northern Nigerian economy, through enhanced Productivity, Re-investment and improvement in the Standard of Living of personnel. Conclusively, ICTs could even save over N103.4 Trillion in future, according to a recent report jointly published by Independent Non-profit Entities and the Climate Group and the Global e-Sustainability Initiative (GeSI).

Sample 3: Distribution according to Government and Private Sectors involvement in the provision of Power Supply to Telecommunication/ICT Sector

Table 5: Mean response to Government and Private Sectors participation in the provision of Power Supply to Telecommunication/ICT Businesses in northern Nigeria.

S/NO.	ITEM	SA	A	DA	SDA	NA	MEAN (X)	REMARK
15.	Nigerian Government through the Ministry of Power has not disbursed enough funds to generate of electric power in Nigeria.	20	14	62	94	190	1.79	Strongly Disagreed
16.	Private Sector has not helped in developing power and energy in northern Nigeria for sustainable development.	28	39	52	71	190	2.13	Strongly Disagreed
17.	The implementation of Government Policies on electric power generation has been successfully implemented in northern Nigeria and Nigeria at large.	26	19	57	88	190	1.61	Strongly Disagreed
18.	There is need for Collaboration and Partnership between the Nigerian Government and NGO's in disbursing more funds to production and implementation of electric power policies in northern States of Nigeria.	111	68	7	4	190	3.50	Strongly Agreed
19.	The current security insurgency in most parts of northern Nigeria has catastrophic effect on Nigeria's Telecommunication infrastructures operators and business.	129	42	13	6	190	3.55	Strongly Agreed
20.	Seminars, Workshops, Refr eshment Courses and Field Works, should be periodically organized for Professionals, Government Officials and the Society on Climate Change and its debacles.	106	72	4	8	190	3.45	Agreed

Source: Researchers' Field Work (2013).

Grand Mean= $\sum(X)$
N

Where $\sum(X)$ = Summation of Number of Means.
N = Number of Variables.

Grand mean= $\sum(X) = 16.03 = 2.67.$
$N \quad 6$

Item 15-20, on the Questionnaire provide answer to Sample Three (3). Analysis shows Item 15, 16 and 17, with Mean of 1.79, 2.13 and 1.61, where rated 'Strongly Disagreed', Item 18, and 19 rated 'Strongly Agreed' , with Means of 3.50 and 3.55, while Item 20 Mean value of 3.45 rates 'Agreed'. The Grand Mean (x), for this Sample is 2.67, indicating Poor Government implementation and Private Sector participation in the generation of sufficient power outages. Despite the huge investment on power sector for northern Nigeria's populace and economy, it is appalling that, that there is no visible demonstration of the preparedness of the Government in tackling this inadequate power complexity. The greatest call for concern is that the "Blue Print" for Nigeria's Development Vision of 2020, gives much acknowledgement of the importance of power and energy to Nigeria's economy, but with poor implementation policies. Private Sector particularly those in Telecommunication/ICT Service provision, like GSM Operators, Multimedia Companies, Internet and Electronic Vendors are all yet to contribute immensely to power generation in northern Nigeria. the Problems with inconsistent electric power could be mitigated through collaborative efforts among Stakeholders: the government, private sector and with the International Communities via implementation of projects, in Key areas, such as researches in power and energy, impacts and generation strategies, emission reduction, technology cooperation strategies, renewable and efficiency energy, in addition to capacity building , just as the Chinese government was keen in collaborating with Nigeria on technology transfer, in it effort to assist in mitigating the impacts of poor power supply across the Federation.

It is expedient, that the northern Nigerian government injects more funds into this endeavor, for a sustainable development. Due to Nigeria's present security challenge, telecoms operators, particularly MTN, others like Airtel, Globacom, Etisalat, Visafone, Multilinks etc' installation in some States of northern Nigeria, have damage by unknown persons. The target on telecommunication facilities, especially the Base Transceiver Stations (BTS) in northern Nigerian cities of Bauchi, Gombe, Kano, Maiduguri, and Potiskum, has let to the damages of about 50 Base Stations in northern Nigeria., and has cost the Service Providers over 3.9 trillion of Naira.

Finding Solutions

Over the years many plans have been introduced and suggested to rectify the sector. Government keeps on saying that it is making progress but for most Nigerians the situation on the ground has not changed.

Central Bank Facility

A new plan by Central Bank of Nigeria (CBN) Governor Lamido Sanusi might bring some real change to the country's electricity supply situation. The CBN recently announced it will extend a N500 billion (US3.3 billion) facility for investment in emergency power projects dedicated to industrial clusters. The funds are to be channeled through the Bank of Industry for on-lending to the deposit money banks.

A number of federal government power projects will be covered under this facility, subject to them being restructured into commercially viable ventures on which banks are willing to take credit risks. These projects include power plants in Lagos (500 MW); Kano (250 MW); Onitsha/Nnewi (200 MW); Port Harcourt/Aba (200MW); Kaduna (225 MW); Funtua/Gusua/MFashi/Zaria (200 MW); Lokoja (200MW); and Maiduguri/Gombe/Bauchi (200 MW). Other power projects currently being financed by banks may also be refinanced from the fund. However, banks will be required to secure the funds drawn with eligible securities.

Involving the Private Sector

Many believe that independent power producers (IPPs) hold the key to improved power generation in Nigeria. A successful recent investment in the IPP space has been the completion of a power plant which supplies the Lagos Water Works with uninterrupted power. Oando, a Nigerian energy firm, built a 14-kilometre transmission pipeline from its grid to the 12.5 MW platform facilities located at the Lagos Water Works Corporation. The water corporation used to receive only eight hours of power supply from the Power Holding Company of Nigeria (PHCN) which impacted negatively on its water treatment and supply capacity.

Another IPP venture currently underway is the building power station in most part of Nigeria. Geometric Power will generate electrical power and sell to two primary groups: the industrial clusters and commercial and residential customers using the existing power distribution network of the public power supply system. Some manufacturing companies, struggling to remain competitive due to the high cost of running a business on generators, have started to find their own solutions to the power crisis. A local firm, Paras Energy and Natural Gas Resources Limited, has reportedly finalized arrangements for a pilot project establishing 8 MW power plant within an industrial cluster in Lagos.

New Sources of Electricity

Nigeria has significant deposits of coal that can be used to generate electricity. Estimated reserves are 190 million tonnes of coal. An Abuja-based company, Western Goldfields, is currently working on a number of projects to convert coal to electricity. Nigeria has also made some progress in the area of renewable electricity. In Kwara State and Lagos State, for example, the state governments are employing solar technology to power street lights. This trend is set to expand to other states. A company called PSC Industries is currently busy building the first solar manufacturing assembly line in Lagos and wants to establish another facility in Cross River State. In the area of wind power, plans are currently also underway to construct a 10 MW wind farm in Katsina State.

Nigeria's power sector faces a host of problems from all quarters and it will take skillful leadership to address the issues. Jonathan Leonard Karshima Shilgba, president of the Nigeria Rally Movement sums up the general frustration of the Nigerian public in an article for Sahara Reporters: 'We don't need a committee on power. We don't need any more promises from either Jonathan or any other national leader. We don't need promises of x megawatts within y period of time.

Conclusion

The prime objective of this Paper is to bring to the burner the Impact of power supply on Telecommunication/ICT-based business sector in northern Nigeria and how Telecoms can be used to generate income create job opportunities, increase the standard of living of the people of northern Nigeria and generate revenue for the government. It is evidence from the reviewed literatures and analysis reached in the Paper, that power supply is a major factor that seriously affects Telecommunication /ICT businesses in northern Nigeria.

A wide cross section of Businesses and Public Services are reliant on Telecommunication Services in northern Nigeria, any service interrupt is likely to have negative implications on northern Nigeria's

economy and Nigeria at large. The emergence of security challenge and complexities in most parts of northern Nigeria in recent times has further indirectly affect northern Nigerian Telecommunication/ICT market. Equally Telecommunication could help rather than hamper the fight against inadequate power supply, through ensuring that ICT Sector manage its own rising effect and maintain reduction from Data Centers, Telecommunications Networks, and the Manufacture, as well as the use of related invention, particularly via strictly adherence to Nigerian Communications Commission (NCC) alongside Association of Telecommunication Companies of Nigeria (ATCON) and Association of Licensed Telecom Operators of Nigeria (ALTON) among others.

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INVESTIGATION ON THE DISTRIBUTION, UTILISATION AND EFFECTIVENESS OF INSECTICIDE TREATED NETS IN RELATION TO MALARIA PREVALENCE IN GOMBE LOCAL GOVERNMENT AREA, GOMBE STATE, NIGERIA.

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Abstract
The study was aimed at investigating the distribution, utilisation and effectiveness of ITNs and its impact on malaria prevalence in Gombe L.G.A. The study was conducted from May-November, 2012. A total of one thousand and fifty household heads from seven wards were randomly selected. A pre-tested questionnaire was used to elicit information on distribution and utilisation of ITNs from household heads and nine hundred and twenty (920) blood samples were collected from the respondents for determining malaria prevalence. Seven hundred and twenty nine (729)(69.4%) respondents had one or more insecticide treated nets. Of this, only 580(52.2%) used them as evidenced by observing the ITNs properly hanged on the beds. However, 385(66.4%) of the used ITNs had one or more holes. Distribution and usage by gender and age shows that more females,548(69.9%) than the males,181(67.8%) had ITNs, although a higher number of males, 153(57.3%) than the females, 427(54.5%) used them. Those within the age bracket 31- 40years old had the highest number of distribution, 245(23.3%) and usage,198(18.9%). Prevalence rates of malaria infection among the study subjects were 323(62.2%), 116(82.3%) and 201(77.3%) for those using ITNs, non-insecticide treated nets and not using net at all respectively. Statistically there was significant difference in malaria prevalence among those using insecticide treated net and those not using ($x2=30.219$, $DF=1$, $P < 0.05$). A pre-intervention record of malaria infection, 6316(91.3%) was compared with the prevalence among the study subjects,640(69.6%) and there was no statistical significant difference in infection in the study area ($x2= 0.767$, $DF=1$, $P> 0.05$).

Keywords: *Investigation, Insecticide, Malaria, Treated nets and Prevalence*

Background to the Study

Malaria is a life threatening parasitic disease and is considered as a complex and overwhelming public health problem. The disease is caused by four species of Plasmodium parasites (P. vivax, P. malariae, P.falciparum and P.ovale), and is transmitted through the bite of infected female Anopheles mosquito during blood meal. About 40% of the global population live in area where malaria transmission occurs. Of this population, the disease threatens the lives of about 3.2 billion people and exerts a great toll on vulnerable pregnant women and killing an estimated one to two million yearly (Joel and Abimbola, 2012). The disease is estimated to cause at least 300-500 million clinical cases each year worldwide, where Plasmodium falciparum causes majority of the infection. More than ninety per cent of world's estimated cases of malaria occurred in Africa, south of Sahara and Subtropical region, where the specific population at risk include pregnant women and children under five years of age. Nigeria alone accounts for nearly 25% of the total malaria burden within Africa (Carter,2010) and the disease is responsible for about 60% of outpatient visit to health facilities, 30% of childhood under one year and 11% of maternal death (Roll Back Malaria, 2005).

The prevention and control measures of malaria include chemotherapy and vector control, which is an important part of global malaria control strategies. The cheapest malaria drug (chloroquine) is rapidly losing its pharmacological effectiveness in almost all endemic countries (Aliyu and Muazu, 2009). In addition, attempt to prevent the disease through other antimalarial drugs and insecticides are threatened due to the emergence and spread of drugs resistant malaria parasite and insecticide resistant vector mosquito (Abebe, et al., 2008). Insecticide treated nets (ITNs) are effective tools for malaria prevention and can significantly reduce severe disease and mortality due to malaria especially among children under five-years. Insecticide treated net were reported to be effective in reducing malaria prevalence, incidence and all-cause of childhood mortality by 20% and significantly reduce anaemia in pregnant woman and incidence of low birth weight (Messay,et al., 2009) However, insecticide treated nets coverage and use remain low and inequitable among different socio-economic group in sub-Saharan Africa (Yazome, et al., 2012). The aim of this work was to investigate the distributional coverage of Insecticide Treated Nets, its utilization and its impact on malaria prevalence in Gombe local government area, Gombe state.

Methodology

Study area

The research was carried out in seven (7) wards (Ajiya, Bajoga, Bolari West, Herwagana, Kumbiya-Kumbiya, Nasarawo and Pantami ward) of Gombe Local Government Area, capital of Gombe state. Gombe local government area is located within the sub – Sudan climatic zone between latitude 120 8'and 100 24'N longitude 112 22' and 110 24'E, altitude 500 meters above sea level. The Local Government Area has a total population figure of 250,000 (National Population Census, 2006) with a total land area of 52.434square kilometre. The major tribes in the local government are Fulani, Hausa, Tangale.

Study Subjects

The study subjects consisted of 1050 household heads and house wives from the seven selected wards (that is 150 from each ward). The subjects were selected through systematic random sampling. This was done by selecting each of the fifth houses from a reference point in each ward.

Pre- survey contact and mobilisation

The investigation started by mobilising and sensitising the people in the selected wards. Permission from the director primary health care Gombe local government was sought and obtained, and verbal consent of each respondent (subject) was sought after adequate information was given to the participants before administering the questionnaire. In addition, permission from the household heads or their representatives was sought in order to enter in to their rooms and inspect the condition of the insecticide treated nets and the way they were hanged.

Data Collection

Data on insecticide treated nets distribution and utilization was collected by conducting a household survey, whereby a pre-tested questionnaire was administered to the household heads. The questionnaire was used in order to elicit information on socio-demographic variables, distribution and level of insecticide treated net utilization. In a situation, where by the household heads were not available at the time of the survey, their representatives were contacted and used for the research. Blood Samples from the study subjects were also collected and examined for malaria parasites.

Also, Hospital based record (Secondary data) on malaria test results prior to the commencement of the distribution of the Insecticide treated bed nets (ITNs) was obtained from the record department of Gombe state specialist Hospital Gombe, Gombe State.

Blood Sample Collection

Safety procedures were adopted in collecting the blood samples and the technique employed was vein puncture techniques. The puncture site was swabbed with 70% alcohol and 5ml blood was collected into EDTA container with sterile needle. Thick and thin films were made on clean slides and labelled accordingly as recommended by WHO.

Microscopic Examination

The prepared slides were stained with field stain and examined under microscope, using oil immersion at 100× magnification to observe for Plasmodium parasite. Presence of ring forms and or Trophozoites of plasmodium indicated positive result while absence of either Trophozoites or ring form indicated negative result after a period of 10 minutes of thorough examination under 100× high power field of microscope.

Data Analysis

The data generated from this study were entered in to an excel software (2010) and later transferred in to SPSS Version 16.0 and used for descriptive Statistics and chi-square was used for analysing the data. The confidence level was set as P= 0.05.

Results

Demographic characteristics

The survey was carried out between the months of May-November 2012. One thousand and fifty (1050) household heads and house wives (total study population) within the age range of 11 -60 years participated in the study .The mean age of the respondents was 33.2±9.8.

Distributional Coverage of Insecticide Treated Nets in the Study Area.

The distributional coverage of insecticide treated nets by Wards in the study area is shown in figure 1. Of the 1050 subject surveyed, 729(69.4%) respondents had at least one (1) Insecticide treated nets in their houses, while 321(30.6%) had no insecticide treated net at the time of survey. Ajiya ward, 82.7%had the highest percentage of people with Insecticide treated nets followed by Pantami, Kumbiya-kumbiya and Herwagana where each had 80.0%, 77.3% and 70.7% respectively. Bajoga had 62.7%, Bolari west 58.0% and Nasarawo ward, 54.7% had the least number. The result revealed that out of the 783(74.6%) female respondents,548(66.9%) had at least one insecticide treated net (Figure2). The highest percentage of females, with insecticide treated nets was from Ajiya ward, 81.7%.This was followed by Pantami,8.4%, kumbiya-kumbiya,75.9%, Herwagana,73.7%, Bajoga,65.1%,Bolari West,61.1% and Nasarawo ward,53.2% had the least Percentage female with ITN. On the other hand, out of the 267 (25.4%) male respondents, 181(13.1%) had at least one insecticide treated nets at the time of the survey. Going by wards, Ajiyaward,85.4% had the highest percentage of males with ITN followed by Pantami, 85.3%, Kumbiya-kumbiya,82.2%, Herwagana, 61.1%,Nasarawo,58.5,Bajoga,56.8% and Bolari West, 48.6% with the least. Statistically, there was no significant difference between the two sexes (X2= 0.453, DF= 1, P> 0.05).The distributional coverage of insecticide treated nets in Gombe local government by age revealed that 245(23.3%) respondents within the age range 31-40 years old had at least one insecticide treated net at the time of the survey, 21-30,210(20.0%), 41-50,133(12.7%), 11-20,97(9.2%), and the least number of people with ITN were from age range more than sixty years of age 01 (0.1%) (Figure3).

Utilization of Insecticide Treated Nets.

Out of the 1050 subjects surveyed 580(55.2%) were using insecticide treated nets at the time of the survey and evidence of usage was demonstrated by observing the net properly hanged on the bed, while 470(44.8%) were not using for different reasons (some did not have it, it disturbs sleeping, some used non-treated nets). The highest level of utilization was from Pantami and Ajiya where 104(69.3%) in each used insecticide treated nets. Then, Herwagana,89(59.3%), Kumbiya-kumbiya,87(58.0%), Nasarawo,76(50.7%), Bajoga, 62(41.3%) and the least level of utilization was from Bolari west,58 (38.7%)(Table1). Considering utilisation by gender, 153(57.3%) of the 267 male respondents used ITNs, with Ajiya ward having the highest number, 30(73.1%). This was followed by Pantami,26(76.5%) Nasarawo,25(70.0%), Kumbiya-kumbiya,23(67.6%), Herwagana,20(55.6%), Bajoga,17(38.6%). Bolariwest,13(35.1%) had the least number (Figure2). The overall level of insecticide treated net utilization among females was 427(54.5%), where Ajiya ward had the highest number of females that used ITNs with a total number of 74(67.9%), Pantami,78(67.2%), Herwagana,69(60.5%), K/kumbiya,64(55.2%), Nasarawo,52(47.7%), Bajoga,45(42.5%) and Bolari West,45(39.8%) at the time of conducting the survey. Statistically there was no significant difference between males and females in terms of ITNs utilization ($X2=0.618$, $DF= 1$, $P> 0.05$).

The result showed that 198(18.9%) respondents within the age range of 31-40 years old used ITNs most, 21-30,165(15.7%), 41-50,111(10.6%), 11-20,70(6.7%),51-60,35(3.3%) and those above60 years of age were the least,1(0.01%)(Figure3).Figure 4 shows the level of conditions of utilized ITNs in the study area. Out of the 580 (55.20%) respondents that used insecticide treated nets, 385(66.4%) used damaged ITNs (that is ITNs that have one or more holes), while 195(33.6%) used good(ITNs without hole(s))ITNs. The highest level of utilization of good insecticide treated nets was from Bolari west,28(48.3%) , followed by Pantami 35(41.3%), Nasarawo 27(36.8%),Bajoga 21(33.9%), Ajiya34(32.7%) and Kumbiya-kumbiya,21(24.1%), while the least was from Herwagana ward, (22.5%)

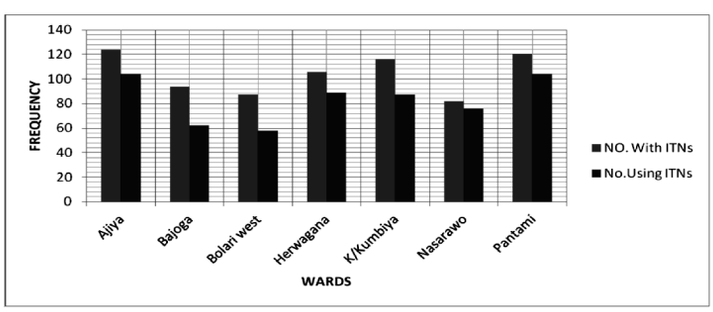


Figure1:Possession and Utilisation of Insecticide Treated Nets in Gombe Local Government Area

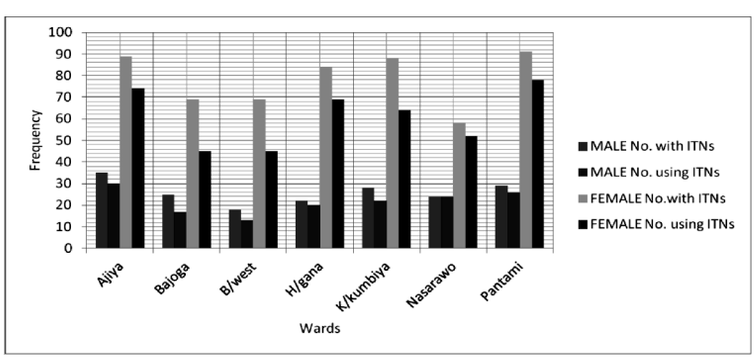


Figure2:Possession and Utilisation of Insecticide Treated Nets in relation to Gender

Pre-intervention Prevalence of Malaria infection in the study area

The Pre-intervention malaria prevalence rates of infection are shown in Figure5. A prevalence rate of infection of 6316 (91.3%) was recorded among the residents of the study area prior to the introduction of the usage of the insecticides treated nets. Considering the result according to wards, Pantami Ward recorded the highest Prevalence of 1317(99.9%), Nasarawo,747(99.6%), Kumbiya-kumbiya,1010 (98.7%), Herwagana,970(89.9%), Bajoga 868(88.9%), Ajiya 759(87.4%) and Bolari west recorded the least prevalence of645(71.5%).

Post-intervention Prevalence of Malaria infection among the study Subjects

Nine hundred and twenty (920) blood samples collected from the study subjects and examined for malaria parasites infection comprised of 519(56.4%), 141(15.3%) and 260(28.3%) for respondents using ITNs, those using non-treated nets and those not using neither ITNs nor non-treated bed nets respectively, at the time of the survey (Figure6). Out of the 519 blood samples from those using ITNs, 323(62.2%) were malaria positive, where Bolari west ward recorded the highest prevalence of 62 (72.5%), Pantami,(71.3%), Kumbiya-kumbiya 51(65.4%), Bajoga 37(64.9%), Herwagana 47 (58.6%), Ajiya 56(56.6%), and Nasarawo Ward had the least prevalence of 33(52.4%).

A prevalence rate of 116(82.3%) was recorded among those using non-treated nets with Ajiya Ward having the highest prevalence of 10(90.9%). This was followed by Bajoga 23(88.5%),Bolari West,20(87.0%), Herwagana,19(86.4%),Kumbiya-kumbiya,12(85.7%), Nasarawo,23(74.2%) and Pantami ward had the least prevalence of 9(64.3%). Statistically there was significant difference in malaria prevalence among those using insecticide treated net and those not using ($x2=30.219$, $DF=1$, $P < 0.05$). Malaria infection rate of 201(77.3%) was recorded among those not using net at all. Result by ward showed that, Bolari west recorded the highest prevalence of 46(83.6%), Ajiya,21(80.8%), Bajoga,38(77.8%), Nasarawo, 25(75.6%), Herwagana,22(71.0%), Pantami,15(62.5%)and Kumbiya-kumbiya ward had the least prevalence of34(59.4%).

Post-intervention results revealed a prevalence rate of malaria infection of 640(69.6%)(Figure 5), where Bolari West had the highest prevalence of 106(79.1%), Bajoga 95 (74.2%), Kumbiya-Kumbiya 96(71.6%), Ajiya 88(66.7%) and Herwagana 88(66.2%), Nasarawo 83(65.4%) and Pantami ward had the least prevalence of 84(62.7%). When the pre-intervention and post-intervention results of malaria infection rates were compared statistically, there was no significant difference in malaria infection in the study area ($x2= 0.767$, $DF=1$, $P> 0.05$).

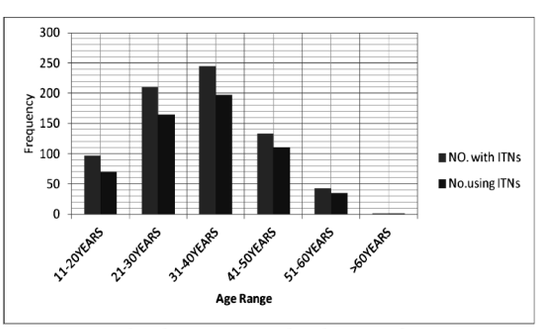


Figure3: Age related possession and Utilisation of Insecticide Treated Nets in Gombe Local Government Area.

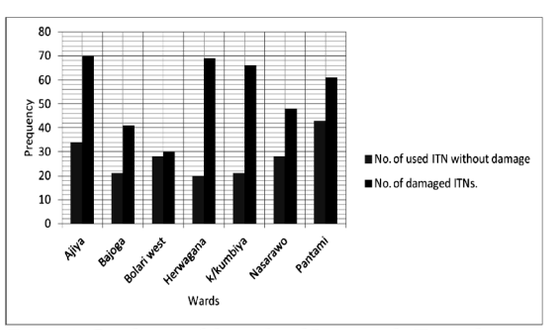
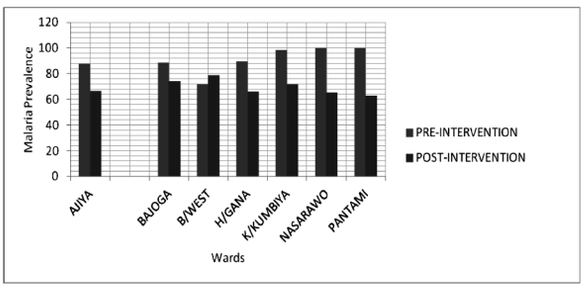


Figure4: Condition of the utilised Insecticide Treated Nets in Gombe Local Government Area



Pre and Post Intervention Prevalence of Malaria in Gombe local Government Area.

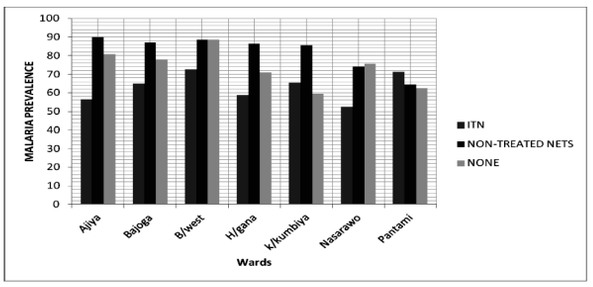


Figure6: Prevalence of Malaria infection among the study subjects in the study Area

Discussion

In this study, the result showed that 69.4% of the respondents had insecticide treated nets at the time of the survey, this result is in agreement with the findings of Torbin and Hart, (2011) and Sibhatu et al., (2012) who reported 68.1%, and 62.4% in Rivers state, and Ethopia respectively. Several factors may be responsible for this high distributional coverage of ITN in the Local government, this could be due to the involvement of some other None Governmental organisations in the free distributional programme of ITNs under the programme of malaria control booster project in collaboration with National Malaria Control Programme (NMCP) /World Bank and the state government. But this is less as compared 89.8% by Envuladu(2011) and 75.3% by Best (2012). This difference could be due to the fact that, most of the Household heads in the local Government obtained their ITN free through free distribution programme. Level of possession by gender revealed 67.8 and 69.9% among males and females respectively, this difference could be due to the fact that the distribution programme focused mainly on women and Nursing mothers, with little attention to men.

The level of insecticide treated nets utilization in the local government revealed 55.2%.Evidence of ITN usage was demonstrated by observing the nets properly hanged on the beds. This result is lower than 81.6% by Abebe, (2008) and 69.0% by Cryrille, (2011). This low level of utilization in the local government may due to lack of personal beds for proper hanging of the ITN and most of the respondents attributed lack of usage to generating heat and disturbing sleeping by the ITN. Utilisation by gender revealed 57.3 and 54.3% among males and females respectively. This difference may be because of some unmarried females participated in the distribution programme and most of them do not have personal beds for hanging the ITNs. Utilisation by age revealed that respondents within the age range of 31-40 used ITNs most, this is may be because most of the respondents within the age range were females and they are most vulnerable to malaria.

The result also revealed that among the household heads who used ITN (n=580) at the time of the survey, 66.4% of the ITN were in damaged condition by having at least one hole/tear. This result is higher as compared to 40.4% obtained by Gashawa, (2008) in southernEthopia. The reason for this may be due to unnecessary washing of the ITN at regular interval and improper hanging using sharp objects like nails. For prevalence of malaria among those using ITNs and those using non-treated nets, the result revealed an overall prevalence of 62.2% and 82.3% respectively. The prevalence of 62.2% among those using ITN may be considered as very high, but this could be attributed to the fact that most of the Household heads used damaged ITN and the ITN is only used when people are in bed, but they could be bitten by the mosquitoes when outside or not in bed. The result is similar to the findings of Pauline, (2011) and Ikeh, (2008), who recorded the prevalence of 65.7% and 57.9% among females in Anambara state, Nigeria and males in Jos

Plateau, Nigeria respectively. The prevalence of 82.3% obtained in this study among those using non-treated nets is similar to the work of Mbanugo and Emenalo, (2004) who recorded 77.4% prevalence among blood donors in Owerri, Imo state, Nigeria. Malaria prevalence of 62.2 and 82.3% was recorded among those using insecticide treated nets and those using non-treated nets. This difference in malaria prevalence may be due to insecticidal (chemical) content of the ITN that could not allow the mosquito to bite even if the ITN is damaged, as majority of the respondents used either ITN or ordinary bed nets that were in bad conditions.

A prevalence rate of 91.3% was recorded before the distribution, this is lower than 69.6% recorded after the distribution. This difference may be attributed to the fact that the entire blood sample collected and examined before the distribution were from patients attending Gombe state specialist hospital who had already developed symptoms of malaria. The overall prevalence of 69.6% obtained in this study is lower than 80.5% recorded by Olasehinde et al., (2010) among infants and children in Ogun state Nigeria. This difference could be due to the low level of immunity by the infants and the children, as majority of the blood sample examined after the ITNs distribution were from adult individuals. Similarly, a prevalence of 91.3% recorded in this study before ITNs distribution is higher than 81.5% obtained by Okonko et al.,(2009) in Abeokuta. This might be because, in this study, the blood samples were collected from symptomatic patients.

Conclusion

The findings of the study revealed that, the local government had achieved an initial goal set by Roll Back Malaria and World health Assembly by achieving more than 60% insecticide treated nets coverage. However, the new target of 80% coverage is yet to be achieved.

The level of utilization is lower than the level of distribution, and most of the household heads that used Insecticide treated nets, used damaged insecticide treated nets, which have at least one hole. In addition, the result showed that, malaria infection is associated with insecticide treated nets usage. The expected effectiveness of the insecticide treated nets in the local government as described by other researchers is seriously affected by the fact that majority of the available Insecticide treated net were in damaged condition. Therefore, this could have affected the effectiveness of the ITNs.

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