Broadband Network Penetration and Growth Pattern in North Eastern Part of Nigeria.

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ABSTRACT: Information and Communications Technology, like many other classical innovations has been institutionalized and become myths binding on organizations. How this seditious tool can be used as a catalyst for developing countries, in the face of empirical anomalies has been a cause for concern. Why does increasing number of agencies go on-line and establish similar web presences with similar structures even when delivery to end user is poor or near impossible? What are the processes of adaption to the environment and pressures of legitimacy and service efficiency? Nigeria, like many other developing nations, confronts huge problems relating to information dissemination. Different government organs have made rigorous efforts to improve the penetration rate. How these efforts affect different regions of the country was the subject of this investigation. Accordingly, multi-stage sampling technique was used to access stakeholders' views from a critical region of Nigeria, using stratified and simple random sampling methods. Key indicators of the results showed that: broadband penetration constitutes a major problem to ICT service delivery{X2 calculated (6.250) was less than X2 tabulated (9.488)}. The impact of Broadband infrastructure as an antidote to improve ICT service delivery indicated X2 calculated (5.185) to be less than X2 tabulated (9.488). The study also arrived at a synergy between speedy broadband growth and technological advancement: X2 calculated (1.559) was less than X2 tabulated (15.507). Evidently, the North Eastern region of Nigeria lacks innovation, capacities and capabilities in broadband network outside few organizations in the capital cities and the financial institutions.

KEY WORDS: Broadband network, Chi-square distribution, Growth indicators, Penetration pattern, Random sampling, stratified sampling.

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1.0 INTRODUCTION

Information and Communications, Biotechnology, Nano-materials and renewable energy technologies are emerging technologies that are exerting impact on the society today. Reviewing recent development on these innovations indicate that ICT is experiencing rapid development into areas of life which a few years ago were

the exclusive reserve of the developed world. The eruption of information connectivity bandwidth, tailored by the significant improvements in micro-technology, and the enforced global competition of countries with access and without access, have revolutionized innovations in Information and Communications technology. A new, complex and rapidly changing technological order has emerged. In this new scenery, knowledge constitutes the most important factor, while learning, which emerges through cooperation, is the most important process. These trends suggest that like the developed nations, developing nations must reinvent their strategies through continuous non-linear novelties in order to achieve strategic competitive advantage.

The impact of telecommunications' infrastructure on the present revolution in service delivery, and how the accelerating growth benefits the society in the developed world, can be sustained in the developing nations.

Within nations, the penetration rate varies greatly between different regions. In Nigeria, broadband penetration is still within one digit level. This is at variance with millions of Nigerians who made several trials to access the Internet. According to findings, these Nigerian consumers use the Internet for research, educational activities, socializing, entertainment, reading news and job hunting, through low bandwidth devices like phones [2]. While developed regions and countries around the world are experiencing faster broadband networks, some regions in Nigeria are experiencing vandalisation of the available ICT facility by militants or insurgents. Thereby, widening the gap of the existing "digital divide". Many factors can be advanced on the need to carry out a methodical study of the impact of broadband penetration in the North Eastern segment of Nigeria. First, this section of Nigeria, among all other geographical locations should be a target for reforms in view of her security challenges, and urgent need for reforms. It also has the highest illiteracy rate in the country. [5] The world over, telecommunications and her allied services have so far proved to be an agent of reforms.. These issues form the nucleus of this study.

1.1 Statement of the Research Problem

ICT, like many other classical innovations are institutionalized and become myths binding on organizations. Apart from their efficiency, cautions about the consensus on key concepts, measures and methods should be reviewed in order to match institutional theory with the operating environment. How certain institutional theories can be used in the face of empirical anomalies. Regulators in ICT need to investigate why organizations and governments employ the process of homogenization in ICT structure without a comparative review of quality of service rendered by this infrastructure. What are the

processes of adaption to the environment and service efficiency? Nigeria, like many developing nations, is confronted with problems of low level broadband penetration and uneven access. Successive governments in Nigeria have made concerted efforts to improve the penetration rate, yet some regions of the country could not pick up with the positive trend of the nation. Penetration is only evident within the state capital city, multi-national organizations and financial institutions. This is in spite of the heavy investment made on telecommunications infrastructure.

Given the poor state of wire line infrastructure in Nigeria [8], and particularly, the vandalisation of mobile telecoms' facilities in the North Eastern part of Nigeria, broadband subscribers rely heavily on low bandwidth delivered by mobile operators for voice services and "sms". And, in some cases, the services are unavailable.

In view of the significance of broadband services, the study examined the level of penetration and growth pattern of broadband network in a largely sub-urban and rural enclave (North Eastern part) of Nigeria.

2.0 LITERATURE REVIEW

Broadband network is one of the reliable transport media for converged signal and Internet access because of its high access speed. It can be offered through any of these media: digital subscriber Line, optical fibre, coaxial cable, communications satellite, wireless media, and microwave.

2.1 Global Broadband Penetration

The penetration of Broadband network is increasing in developed countries than the developing nations. Example, between 2005 and 2008, Eastern Europe increased her broadband subscriber base by 19.5 million. Similarly, subscription by African nations had 2.4 million additional broadband subscribers; earning a market penetration of only 0.36 per cent [7].

Table 1: Global Broadband Subscribers and Penetration Rate

Region	Fixed & Wireless Broadband Subscribers (million)	Market Penetration Rate (per 100 population)
Africa	24	2.4
China	103	7.7
Rest of Asia	292	12.0
Eastern Europe	55	16.2
Latin America	62	10.8
Middle East	42	13.4
US & Canada	174	51.4
Western Europe	262	64.3
Total	1014	15.0

Source: IJED Vol. 1 Iss. 1, 2011 PP. 34-37

2.2 African Broadband Penetration

According to a recent publication by Informa Telecoms & Media, the dominant access of ICT network in African countries deploy wireless infrastructure [6]. The

study further gave the average rate of mobile penetration for Africa as fluctuating between 28.46 per cent and 31.2 per cent. According to researchers, Africa's fixed-line networks have very poor penetration level when compared to mobile subscription. Comparatively, this accounted for only 1.3 per cent (Fixed broadband household penetration) in Africa, to 57.74 per cent in North America (US and Canada). Africa's telecommunications connectivity to the outside world was vastly limited to few intercontinental submarine cable (SAT-3) located under the sea along the Western coast. This resulted to Africa's alternate dependence on the limited satellite transponders for connectivity outside the African's shores. This trend has lead to low penetration of e-government in many African countries. This survey is supported by a report published by United Nations: ranking Africa as having the lowest penetration level in the world [3].

2.2 Nigerian Broadband Penetration

In a recent publication by the International Telecommunications Union (ITU), it was noted that comparisons relating to broadband growth are always difficult to make between developing countries. In the face of these difficulties, two charts representing a developing nation: Nigeria and the developed economies: the BRICS countries (Figures 1 and 2) were plotted to compare Nigeria (the orange line in Figure 1 below) with the BRICS (Brazil, Russia, India, China and South Africa) countries in terms of broadband subscribers and penetration base between 2001 and 2011 [7]. Although Brazil has a larger population, the figure shows that the rate of growth is faster than Nigeria's. Figure 2 displays the penetration rate per hundred inhabitants over the same period. From this analysis, Nigeria fits in the middle of the range of the BRICS countries. This can be attributed to the rapid increase in broadband penetration after the issuance of Unified Licenses and the 2.1GHz (3G) spectrum licensing.

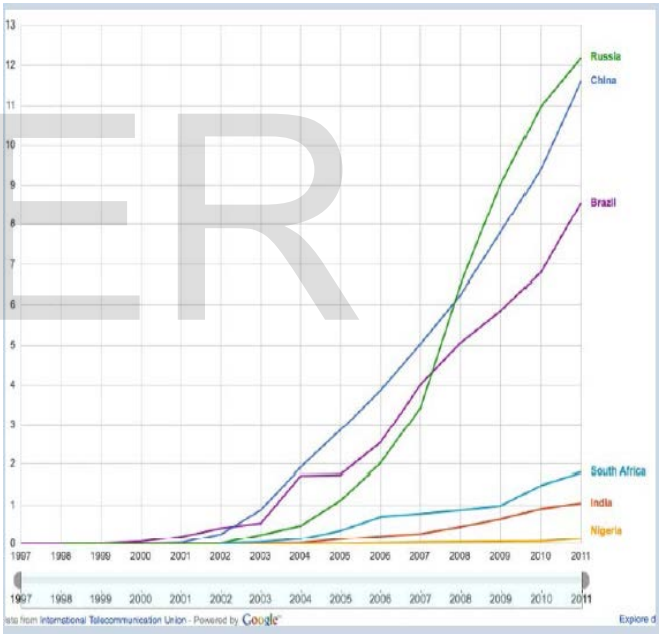

Fig. 1: Comparative view of broadband subscribers: Nigeria vs. BRICS, 2001-2011 *Source: ITU, www.itu.int/icteye*

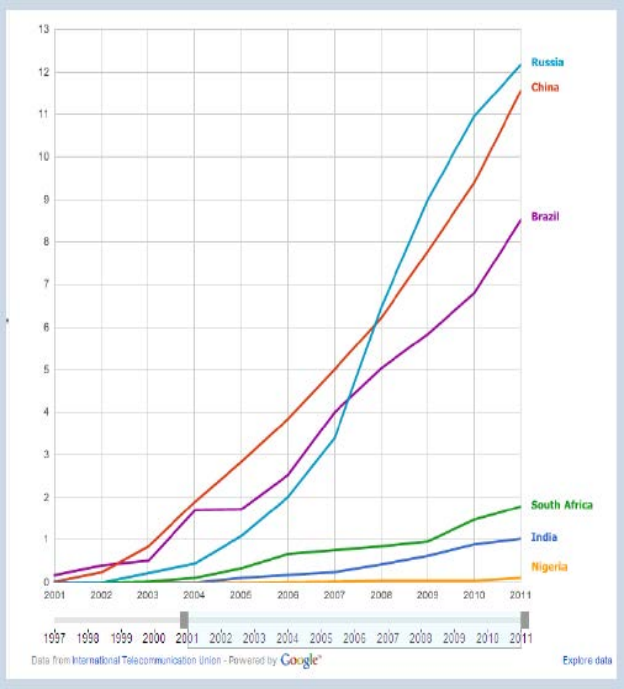

Fig. 2: Broadband penetration: Nigeria vs. BRICS, 2001-2011*Source: ITU, www.itu.int/icteye*

Analyses from recently available data on Nigeria (2011), indicates Internet penetration rate of 22.1 per cent, while broadband penetration rate stood at 6.1 per cent. Further analysis on data usage indicates 33.5 million Internet users. Penetration rate for Personal computer (PC) is 4.7 per cent. Penetration of Broadband services recorded 3 per cent to 6 per cent. These results indicate that Nigeria has considerable challenges; in spite of the rapid increase in mobile Internet usage. Reviewing estimates for 2011, shows that there are about 800,000 broadband services' users. Out of this figure, 74 per cent were accessed through mobile voice-bandwidth networks under the challenges of slow network- speed.

It is envisaged that by the end of 2015, Nigeria would have full access to five international submarine cables (SAT3, Glo One, Main One, WACS and ACE.); a positive development that may reduce the wholesale cost of international bandwidth to about US$100 per Mbps per month as against over US$6,000 per Mbps per month in 2004 [7].

Table 2 and Table 3: Price comparisons: Nigeria vs. competitive markets in Africa, 2011

Country and Type	Monthlycost	Cost per Mbps/MB	Notes
Ghana			
Householdfixed: 2 Mbps	US$35.74	US$17.87	ADSL
Householdfixed: 20 Mbps	US$172.09	US$8.60	ADSL
Mobile bundle 1.5 GB	US$20.42	US0.136 cents	3G
Mobile bundle: 2.5 GB	US$30.64	US0.122 cents	3G
Kenya			
Fixedhousehold: 10 Mbps	US$116	US$11.60	Fibre-to-the-home
Fixedhousehold: 20 Mbps	US$172.09	US$8.60	Fibre-to-the-home
Mobile bundle: 1 GB	US$9.92	US0.9 cents	EVDO
Mobile bundle: 20 GB	US$110.77	US0.5 cents	EVDO
Nigeria			
Wireless household: 1 Mbps	US$39.76	US$39.76	WiMAX – 5 GB downloadlimit
Wireless household: Not given	US$73.75	Speed not known	EVDO – 15 GB downloadlimit
Mobile bundle: 1 GB	US$22.08	US2.2 cents	3G & 3G+
Mobile bundle: 5 GB	US$50.49	US0.1 cents	3G & 3G+
South Africa			
Fixedhousehold:1 Mbps	US$35.58	US$35.58	ADSL
Fixedhousehold:4 Mbps	US$50.85	US$12.71	ADSL
Mobile bundle: 1 GB	US$30.65	US3 cents	3G & 3G+
Mobile bundle:10 GB	US$352.03	US0.17 cents	3G & 3G+

Source: Broadband Commission for Digital Development, ITU

Table 3: Key players in the Nigerian Broadband Environment.

Industry Operator	Functions
NCC	ICT industry regulation
NITDA	IT industry support and development
NIPOST	Postal service delivery and access infrastructure
Galaxy Backbone	ICT infrastructure provision for Federal Government and its agencies
NIGCOMSAT	Commercialisation of Government's satellite resources
USPF NITDF	Managed fund to incentivise universal access
NFMC	Prudent and co-ordinated allocation of frequency resources
Ministry of Communication Technology	Policy formulation Policy impact assessment Supervision and oversight of all MDA ICT related projects and initiatives

3.0 CHAPTER THREE: CONCEPTUAL FRAMEWORK

The study was conducted in the North Eastern zone of Nigeria. The selection of the study area was influenced by perceived insufficient availability of ICT network resources, or ICT network depletion due to insurgency in the area. The choice was anchored on using a broadband base-line zone, in order to ensure that the worst scenario is used as a pilot case-study of Broadband penetration and growth pattern in Nigeria.

Collection of Data was based on primary and secondary sources. Primary data was gathered from the field through the use of observations, questionnaires and interviews, while secondary data came through sources such as books, journals and Internet. Questionnaires were framed to cover primary data details such as: characteristics of stakeholders and operators in this geo-political zone, broadband network penetration, growth pattern of ICT in areas where Broadband penetration is visible. Further examples of secondary data include: age distribution, educational qualifications and assessment of levels of proficiency of respondents on ICT, among others.

The first and main survey spanned a period of three months (in view of the coverage area), while the second survey took 20 days. The focus here was to assemble additional data as well and mop up identified gaps on the initial survey. 150 questionnaires were randomly distributed to stake-holders. Out of these, 90 were returned with relevant responses, 35 invalid and 25 declined responses. In addition, 72 (18 per state) stakeholders were interviewed during the field surveys. Multi-stage sampling techniques were used to collect individual data using both stratified and simple random

sampling methods. Individuals in the metropolis were grouped into two main strata (network operators and stakeholders). To ensure that every stakeholder has equal selection chance, simple random sampling method was employed from the sample population. Since it is a quantitative research data, Chi-square distribution was adopted to test the viability and reliability of the hypotheses formulated in the study, among other relevant statistical tools such as the regression analysis, the correlation analysis, the students t-test and z-test, the f-test, the significance of percentages, the standard error, the standard deviation, the probability test, and the Wilcoxon two-sample test, [5] etc. The reason for the choice of Chi-square, symbolized by X^2, as the statistical measure is that X^2 has a theoretical sampling distribution which permits us to address research problems involving frequencies where the variables have been classified into two or more mutually exclusive categories. Besides, X^2 is most often used in evaluating research data reported in frequencies, such as proportions and percentage.

The sampling statistic for testing the feasibility of the null Hypothesis under Chi-square is defined by the formula [5]

$$X^2 = \sum (f_0 - f_e)^2 / f_e \quad \text{..... (1)}$$

Where f_0 = observed frequencies in a category (generated from sample data);

f_e = Expected frequencies in the same category (generated from sample data):

f_e = Expected frequencies in the same category (provided by population parameters):

$\sum$ = Sum this ratio over all columns and rows.

The sampling distribution of the Chi-square is a function of the associated degree of freedom (df). In Chi – square, the df is based on the number of categories symbolized by K.

Significance Level and the Rejection Region(s)

Significance level must be chosen before the test is carried out, as a critical factor in deciding whether to accept or reject a Hypothesis. This is why the term 'significance testing' is commonly used instead of Hypothesis testing. It cannot be said with 100 per cent certainty that a difference is significant since samples and random factors are being handled. Accordingly, various levels of significance are usually chosen; most commonly are 5 per cent or 1 per cent. Thus, the result of a particular test might be expressed as follows: "the difference between the sample mean and the hypothetical population mean is significant at the 5 per cent level.

Or

There is a 95 per cent confidence that the difference between the sample mean and the population mean is not due to chance factors''.

The score for a two tailed test at the 5 per cent level is 1.96.

The significance level is set at 0.05, two tailed. The selected three hypotheses will be tested at 5 per cent level of significance with (r-1) (c-1) degree of freedom. If X^2calculated is greater than X^2tabulated, then, the Null Hypothesis (H_0) is rejected; otherwise, the Null Hypothesis is accepted.

4.0 DATA COLLECTION AND ANALYSIS OF THE PERCEPTION INDEX

Computations of key (selected from numerous questions) research questions were collated. Statistical analyses were carried out and conclusions drawn based on findings from both primary and secondary data(s). To achieve this, the expected frequency for each cell was determined and the relevant formula applied.

Test of Hypothesis 1

H_0: Broadband Network growth rate is very slow.

H_1: Broadband Network growth rate is not very slow.

Data collected based on these hypotheses are presented in Table 4. The numbers in each cell of the table without brackets are observed frequencies, while those in brackets are the expected frequencies.

Table 4: Broadband network penetration rate is very slow and constitutes a major problem to ICT stakeholders.

Quest /Rank	Strongly agree	Agree	Neutral	Disagree	Strongly Disagrees	Row total (R_i)
1	40 (40)	35 (40)	15 (10)	0 (0)	0(0)	90
2	40(40)	45 (40)	5(10)	0 (0)	0 (0)	90
Column Total (C_i)	80	80	20	0	0	180

e_{11} = (90*80)/180 = 40

e_{12} = (90*80)/180 = 40

e_{13} = (90*20)/180 = 10

e_{14} = (90*0)/180 = 0

e_{15} = (90*0)/180 = 0, etc.

Table 5: Contingency table for Test of Hypothesis 1.

CELL	F_0	F_E	F_0-F_E	F_0-F^2_E	F_0-F_E^2/ F_E
$A: r_1c_1$	40	40	0	0	0
$B: r_1c_2$	35	40	-5	25	0.625
$C: r_1c_3$	15	10	5	25	2.5
$D: r_1c_4$	0	0	0	0	0
$E: r_1c_5$	0	0	0	0	0
$F: r_2c_1$	40	40	0	0	0
$G: r_2c_2$	45	40	5	25	0.025
$H: r_2c_3$	5	10	-5	25	2.5
$I: r_2c_4$	0	0	0	0	0
$j: r_2c5$	0	0	0	0	0

Expected frequencies are obtained thus:

Designing a 10-cell contingency table:

Where r represents number of rows and crepresents number of columns

X^2_{cal} = 0 +0.6250 + 2.5 + 0+0+0+0.6250 + 2.5+0+0 = 6.250

$$df = (r-1)(c-1)$$
$$= (2-1)(5-1)$$
$$= 1*4$$
$$= 4$$

With 4 df, the critical X^2 value required for significance at 0.5 significance level is 9.488 (from table).

That is, X^2 (tabulated) = X^2 (r-1) (c-1);

0.05=X^2df, 0.05 = 9.488

Remark: If the computed Chi-Square value exceeds the tabulated critical Chi-Square value at a specified level of significance, then the null Hypothesis is rejected [4]. In

other words, there is justification for the claim that Broadband Network growth rate is very slow. Since X^2 calculated (6.250) is less than X^2 tabulated (9.488), H_0 is accepted and it is concluded that Broadband network growth rate is indeed very slow.

Test of Hypothesis 2

H_0: the Impact of Broadband Infrastructure penetration will revolutionize ICT service-delivery.

H_1:The Impact of Broadband Infrastructure penetration will not revolutionized ICT service-delivery.

The data collected based on these hypotheses are presented in Table 6:

Table 6: The Impact of Broadband Infrastructure penetration will revolutionized ICTservice-delivery.

Quest /Rank	Strongly agree	Agree	Neutral	Disagree	Strongly Disagrees	Row total (R_i)
3	38(39)	44(40)	5 (6)	3 (3)	0 (2)	90
4	40 (39)	36 (40)	7 (6)	3(3)	4(2)	90
Colu mn total (C_i)	78	80	12	6	4	180

Table 7: Contingency table for Test of Hypothesis 2.

CELL	F_0	F_E	F_0-F_E	$F_0-F^2_E$	$F_0-F_E^2/F_E$
$A: r_1c_1$	38	39	-1	1	0.02564
$B: r_1c_2$	44	40	4	16	0.4
$C: r_1c_3$	5	6	-1	1	0.16667
$D: r_1c_4$	3	3	0	0	0
$E: r_1c_5$	0	2	-2	4	2
$F: r_2c_1$	40	39	1	1	0.02564
$G: r_2c_2$	36	40	-4	16	0.4
$H: r_2c_3$	7	6	1	1	0.16667

$I : r_2 c_4$	3	3	0	0	0
$j : r_2 c_6$	4	2	2	4	2
					$\sum X^2 = 5.185$

Expected frequencies are obtained thus:

e_{11} = (90*78)/180 = 39

e_{12} = (90*80)/180 = 40

e_{13} = (90*12)/180 = 6

e_{14} = (90*6)/180 = 3

e_{15} = (90*4)/180 = 2, etc.

Designing a 10-cell contingency table:

Where r represents number of rows and c represents number of columns.

X^2_{cal} = 0.02564+0.4+0.16667 + 0+2+ 0.02564 + 0.4 + 0.16667+0+2= 5.185

$$df = (r-1)(c-1)$$
$$= (2-1)(5-1)$$
$$= 1*4$$
$$= 4$$

With 4 df, the critical X^2 value required for significance at 0.05 significance level is 9.488 (from table)

Remark: Since X^2 calculated (5.185) is less than X^2 tabulated (9.488), H_0 is accepted and it is then concluded that the Impact of Broadband Infrastructure penetration will revolutionized ICT service-delivery.

Table 8: The adaptation and implementation of a speedy broadband growth strategy will launch Nigeria into the 21st century technological change.

Quest /Rank	Strongly agree	Agree	Neutral	Disagree	Strongly Disagrees	Row total (R_i)
5	43(41)	35 (37)	7(8)	3 (2)	2 (2)	90
6	40 (41)	38 (37)	9(8)	1(2)	2(2)	90
7	40(41)	38	8(8)	2(2)	2(2)	90

		(37)				
Column total (C_i)	123	111	24	6	6	270

Test of Hypothesis 3

H_0: The adaptation and implementation of a speedy broadband growth strategy will launch Nigeria into the 21st century seditious technological change.

H_1: The adaptation and implementation of a speedy broadband growth strategy will not launch Nigeria into the 21st century seditious technological change.

The data collected based on these hypotheses are presented in Table 8:

Table 9: Contingency table for Test of Hypothesis 3

CELL	F_0	F_E	F_0-F_E	$F_0-F^2_E$	$F_0-F^2_E/F_E$
$A: r_1c_1$	43	41	2	4	0.09750
$B: r_1c_2$	35	37	-2	4	0.108108
$C: r_1c_3$	7	8	-1	1	0.125
$D: r_1c_4$	3	2	1	1	0.5
$E: r_1c_5$	2	2	0	0	0
$F: r_2c_1$	40	41	-1	1	0.02430
$G: r_2c_2$	38	37	1	1	0.027027
$H: r_2c_3$	9	8	1	1	0.125
$I: r_2c_4$	1	2	-1	1	0.5
$j: r_2c_6$	2	2	0	0	0
$K: r_3c_1$	40	41	-1	1	0.02430
$L: r_3c_2$	38	37	1	1	0.027027
$M: r_3c_3$	8	8	0	0	0
$N: r_3c_4$	2	2	0	0	0
$O: r_3c_6$	2	2	0	0	0
					$\sum X^2 = 1.559$

Expected frequencies are obtained thus:

e_{11} = (90*123)/270 = 41

e_{12} = (90*111)/270 = 37

e_{13} = (90*24)/270 = 8

e_{14} = (90*6)/270 = 2

e_{15} = (90*6)/270 = 2

e_{21} = (90*123)/270 = 41

e_{22} = (90*111)/270 = 37

e_{23} = (90*24)/270 = 8

e_{24} = (90*6)/270 = 2

e_{25} = (90*6)/270 = 2

And so on.

Designing the 15 – cell contingency table:

Where r represents number of rows and c represents number of columns

X^2_{cal} = 0.09756 + 0.108108 + 0.125 + 0.5 + 0+0.02439+0.027027 + 0.125 + 0.5 + 0+

0.02439 + 0.027027 + 0+0+0+0 = 1.559

$$df = (r-1)(c-1)$$
$$= (3-1)(5-1)$$
$$= 2*4$$
$$= 8$$

With 8 df, the critical X^2 value required for significance at 0.05 significance level is 15.507 (from table)

Remark: Since X^2 calculated (i.e. 1.559) is less than X^2 tabulated (i.e. 15.507), H_0 is accepted and it is concluded that adaptation and implementation of a speedy broadband growth strategy will launch Nigeria into the 21st century seditious technological change.

5.0 DISCUSSION

Different empirical analyses in developed nations had proven broadband services as a stimulant to not only ICT growth, but also GDP growth [4 and 6]. Realizing the importance of broadband and its accruable benefits, the study examined the level of penetration and growth pattern of broadband network in a largely sub-urban and rural enclave (North Eastern part) of Nigeria. This is with a view to coming up with solutions that can generally improve the broadband connectivity level in Nigeria; using the most disadvantaged part of Nigeria as a case-study.

Accordingly, multi-stage sampling technique was used to access stakeholders' views using stratified and simple random sampling methods. Key indicators of the results showed that: inadequate broadband penetration constitutes a major problem to ICT service delivery {X^2calculated (6.250) was less than X^2tabulated (9.488)}. The impact of Broadband infrastructure as an antidote to revolutionize ICT service delivery, indicated X^2 calculated (5.185) to be less than X^2 tabulated (9.488). A synergy was also arrived at between speedy broadband growth and technological advancement: X^2calculated (1.559) was less than X^2 tabulated (15.507). Evidently, the North Eastern region of Nigeria at present lacks innovation, capacities and capabilities in broadband network outside the capital city, multi-national organizations, financial institutions and the cosmopolitan section of Lagos. The study found the growth rate of broadband penetration in North Eastern Nigeria to be slower than the national estimate: increase

from 0.64% in the early 2000 when the telecommunications industry was liberalized to the single digit growth rate pattern experienced presently. However, this 'snail-speed' growth was caused by the poor state of wire line infrastructure in Nigeria [2 and 8] and particularly the vandalisation of mobile telecoms facilities in the North Eastern part of Nigeria; thereby causing broadband subscribers to rely heavily on low bandwidth delivered by mobile operators.

6.0 CONCLUSION

The results showed that poor broadband penetration constitutes a major problem to ICT service delivery in the North Eastern part of Nigeria. The impact of Broadband infrastructure as an antidote to revolutionize ICT service delivery was correlated by the study. A synergy was also arrived at between speedy broadband growth and technological advancement. Evidently, the North Eastern region of Nigeria lacks innovations, capacities and capabilities in broadband network outside few organizations in the capital cities and the financial institutions.

The impact of telecommunications infrastructure on the present revolution in service delivery and how the accelerating growth benefits the society in the developed world, can be sustained in the developing nations on long-term competitive basis, if the government and regulators initiate a more pragmatic approach to entrenching broadband network across the country. Imperatively, apart from the North East Zone of Nigeria, the country urgently needs to develop detailed and realistic plans and policies to protect and improve fibre connectivity, by harnessing public-private sector initiatives. Similar studies should be conducted in other parts of the country to verify broadband growth rate

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