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Fixed Wireless Access as a Veritable Resource for Rural Communities in a Cashless Economy

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Abstract Since liberalization of the telecoms industry in 2001, Nigeria Tele-density is growing at an alarming rate. Strong demand for Internet services and broadband capabilities is aiding the development of the fixed-line sector in Nigeria. The question of what is the availability of Fixed Wireless Network in the rural areas and what is the attitude towards adoption of fixed wireless conceived this research. The major focus of this work is to design a model to alleviate the shortage of fixed wireless deployment in Nigeria rural areas by investigating the total number of fixed wireless subscribers and the percentage penetration of fixed wireless technology/access in Africa's most populous nation which is considered the fastest growing telecommunication market in Africa. This is with a view to forecast the potential of Nigeria in becoming one of the 20 most industrialized nations by 2020.

Keywords Fixed Wireless Access (FWA), Telecoms, Broadband, Fixed Wireless Subscribers

1.Introduction

We live in an age in which communication between people is essential to achieving shared goals for development and peaceful coexistence[1]. It has been reported in literature that growth in telecoms has contributed in no small way to country's economic growth. For example in United States, it is reported to have created about 3.6 million jobs since inception[2] and in UK about 2.1 million jobs in one year[3].

In Nigeria its liberalization has added 1,457,917 direct and indirect jobs to the Labour market and it has increased the GDP to 3.5 per cent in 2011 up from 0.06 per cent in 1999, and this is expected to surpass 7 per cent by the end of 2012[4]. The question now is "is there no divide between the rural and urban areas relative to telecoms infrastructure coverage, especially in a developing country preparing for a cashless economy?"

1.1. The Concept of Fixed Wireless

Broadband wireless network is classified into two namely; fixed and mobile. Reference[5] defined fixed broadband wireless technologies as high-speed wireless networks that connect to stationary locations and are intended to serve nomadic users (see fig. 1). Rural or remote areas is characterized by: scarcity or absence of public facilities and technical personnel, difficult topographical conditions, severe climatic conditions, low level of economic activity, low per capita income, underdeveloped social infrastructures, low population density, very high calling rates per telephone line.

It is this type of wireless technology used to help in communication between two locations such as two buildings or two offices for the sake of business and for different purposes with the help or involvement of micro waves such as radio waves. Basically technology of fixed wireless is totally based on the Wireless LAN infrastructure phenomenon[6], sometimes the radio waves which are used for communication between two sites form a bridge is known as Laser Bridge[7].

Fixed Wireless Access removes the need to drape wires across the country or dig up roads to provide fixed telecommunication links, as is the case for fixed telephony and cable networks[8]. Fixed wireless is applicable in those areas where there is no chance of wired networking, for example, in rural areas there is no wired infrastructure technology available yet, so this problem has been solved by fixed wireless and fixed wireless broadband. This has become a very successful and viable option for deployment of internet technology in those unreachable areas[9]. Hence, fixed wireless would provide fast, always on access to the Internet, high capacity data transfer, on-line banking cum shopping and many other services, to under-served areas.

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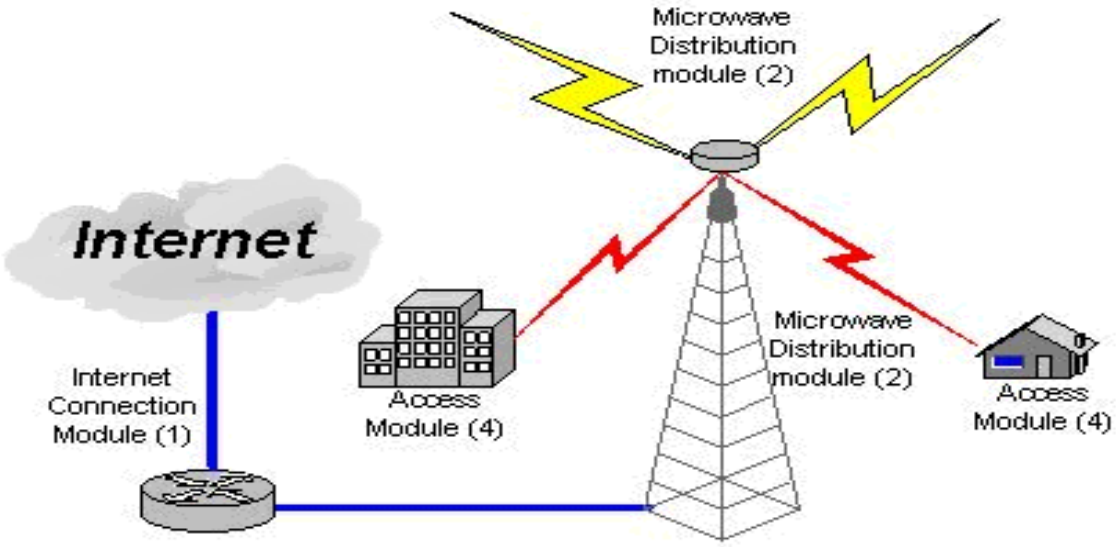

Figure 1. Fixed wireless access configuration. ***Source:*** *Prairie iNet*

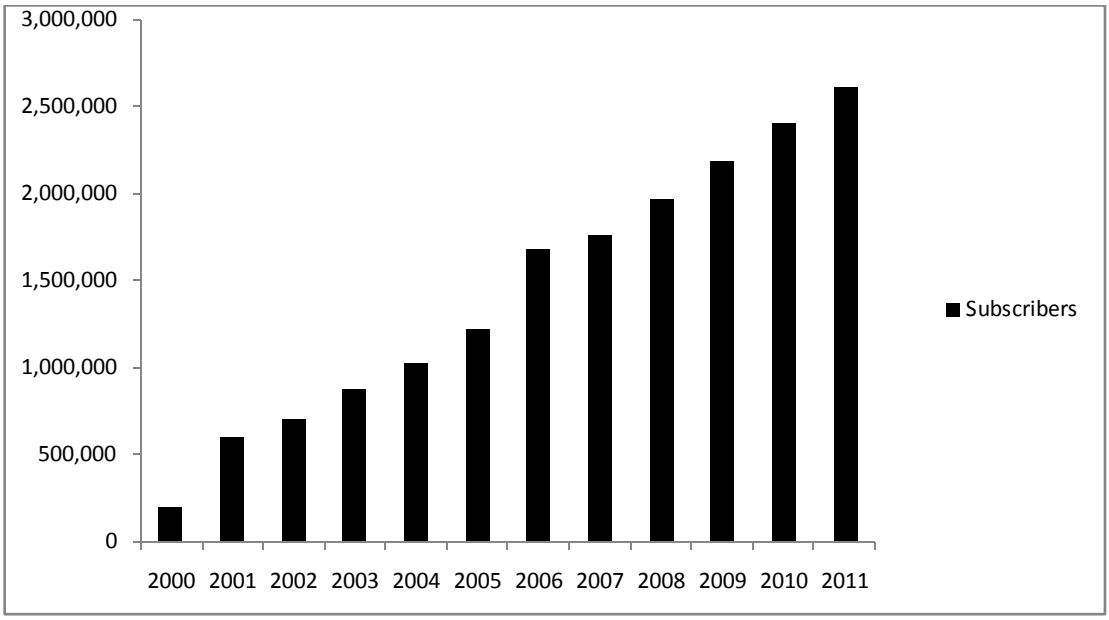

Figure 2. Fixed wireless subscribers in Nigeria ranging from 2000 to 2011

1.2. Rural Communities and Fixed Wireless Access

Rural markets have traditionally been served by fixed wireless access (FWA) systems such as point-to-multipoint (PMP) radio, which is generally considered a quick and economical way to implement communications infrastructures that link these areas to the rest of the world[10]. The advantage of the fixed wireless network is that once connectivity is brought into a rural locale, it can be spread over a larger area by setting up a fixed wireless network through Wi-Fi hotspot or Wi-Fi mesh network[11].

Use of Fixed Wireless Broadband Access can be utilized effectively and economically to serve rural areas, and bridge the 'Digital divide', but can also be used to serve peri-urban and urban areas as part of a solution mix of technologies[1].

1.3. Fixed Wireless Access in Nigeria

In reference[12], fixed Wireless network was first introduced in the country since 1992 when the sector was deregulated in order to allow private sector participation due to the unreliability of the then Nigeria Telecommunications Limited (NITEL), the state-owned fixed line operator. In order to meet the demand for communications, nearly thirty licenses were issued to Private Telecommunications Operators (called PTOs) but with no significant improvement in the industry. The growth of the telecoms in Nigeria since its liberalization in 2001 is unprecedented. It is worth noting to state that up until 2001, the total active telephone lines both fixed and wireless stood in the neighbourhood of 500,000 lines. Today, Nigeria Tele-density is growing at an

alarming rate since liberalization of the telecoms industry in 2001[13].

Since its introduction, Nigeria has enjoyed broad deployment of high speed technology in hotspot around Nigeria including homes and offices, and increasingly in cafes, universities, hotels, and airports[5].

There are 24 Fixed Wireless Operators in Nigeria as at 2005[14], some of which include Starcomms, Multi-Links, Zoom, Rainbow Net, Intercellular, Standard, MTS First and Odua Tel among others. Multi-Links started operations in December, 1997 as the first private company to roll-out fixed wireless phones in Nigeria, it started its Network operations in Lagos and could only boast of over 100,000 subscribers[9]. Today Nigeria is proud of about sixteen CDMA operators providing fixed wireless and full mobile services with a total number of subscribers above 90.5 million as at November, 2011[15].

According to NCC, Nigeria's has 2,762,047 Fixed Wireless subscribers as of March 2011, 2% of the population and population growth is as shown in Figure 2.

Strong demand for Internet services and broadband capabilities is aiding the development of the fixed-line sector, which at a market penetration of just over 1% still has enormous growth potential[16]. Amid these benefits are some concern which culminated into the following research questions: (i) what is the availability of Fixed Wireless Network in the rural areas in Nigeria?(ii) what is the literacy level in the use of ICT devices in the rural areas among the dwellers?(iii) what is the attitude towards adoption of fixed wireless?

The major focus of this work is to design a model to alleviate the shortage of fixed wireless deployment in Nigeria rural areas. The specific objectives are to:

i. measure the preparedness of the rural communities vis-a-vis the available infrastructure towards a cashless society;

ii. project future access in preparation for vision 20 2020;

iii. suggest appropriate policy options to facilitate deployment of a fixed wireless service.

2. Methodology

This research employed a qualitative approach to investigate the total number of fixed wireless subscribers and the percentage penetration of fixed wireless technology/access in Nigeria. This work used the fixed wireless data between year 2000 and 2011 available on NCC website, the Nigerian telecom industry regulator and Nigeria population data and the percentage penetration gotten from CIA World Fact book. The tool used to further analyse the data gathered was extrapolation to project the relative increase in the number of subscribers and to also calculate the percentage penetration with the data of 2000 to 2011. The extension of the projection is pegged at year 2020; this is with a view to seeing the picture of Nigeria in its drive to becoming the 20 most industrialized nations by 2020.

3. Result and Discussion

It was observed there has been an upward increase in the number of subscribers/users of fixed wireless access in Nigeria (Table 1). For example between 2000 & 2002, the number of fixed wireless subscribers incresaed by 500,000 in a space of only two years. This compares with the total subscribers (both fixed and wireless) before the liberalization which also stood at about 500,000 lines. It was also observed that in a space of ten years from 2001 there was an upsurge of over 1000% of additional fixed wireless subscribers atttained[17]. These unprecedented growth is the first recorded in telecoms industry in Africa.

Table 1. Fixed Wireless/Wireless Subscribers data and Population Growth

Year	Subscribers	Population	Percentage penetration
2000	200,000	123,337,800	0.16%
2001	600,321	126,635,600	0.47%
2002	702,000	129,934,900	0.54%
2003	872,473	133,881,700	0.65%
2004	1,027,519	137,253,100	0.75%
2005	1,223,258	128,772,000	0.95%
2006	1,673,161	131,859,700	1.27%
2007	1,853,848	135,031,200	1.37%
2008	2,141,453	146,255,300	1.46%
2009	2,445,423	149,229,100	1.64%
2010	2,736,373	152,217,300	1.80%
2011	2,762,047	155,215,600	1.78%

Source: Subscribers data from NCC (Annual Subscriber data March, 2000 to 2011) and Nigerian Population from CIA World Fact book (January, 2011)

The graphical projection for Fixed wireless subscribers in Nigeria ranging from 2000 to 2011 is given in figure 3 below:

Using subscribers data from 2000 to 2011, a projection from 2012 up to 2020 was computed with an expected upward increase in the subscribers/users of fixed wireless access with increasing population. A lot of comparism was made between the years and the most considered was between 2000 to 2005 which was then used to compare the figures between 2006 to 2011 to determine a more approprate model for projecting the upward increase in subscribers/users of fixed wireless network in Nigeria. The corresponding percentage penetration was also generated for the same period.

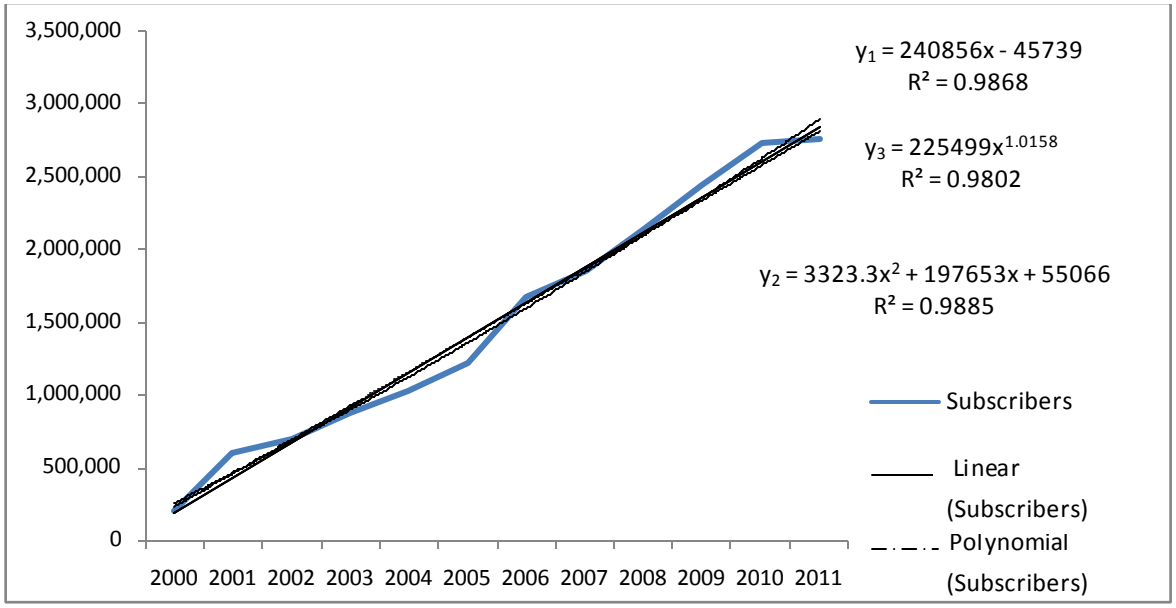

Figure 3. Graph showing the trendlines used

Inconsistency pattern is noticed in the growth of the fixed wireless over 12 years period from 2000 to 2011. This makes it difficult to accurately forecast the number of fixed wireless subscriber in Nigeria by the year 2020 to meet up with vision 2020.

This work explored modeling tools to model a best fit for the growth. The regression type used include: linear, polynomial and power regressions

3.1. Model

The models considered using the three (3) regression/ trendlines are as follows:

3.1.1. Linear Regression/Trendline

Using the linear regression/trendline with data from 2000 to 2011 we obtained a model

$y_1 = 240856x - 45739$

$R^2 = 0.9868$

3.1.2. Polynomial Regression/Trendline

The model obtained using the Polynomial regression/Trendline is

$y_2 = 3323.3x^2 + 197653x + 55066$

$R^2 = 0.9885$

3.1.3. Power Regression/Trendline

The model for Power regression/Trendline is

$y_3 = 225499x^{1.0158}$

$R^2 = 0.9802$

Figure 3 above shows the inconsistent patterns and the different trendline used in preparing the different models for Linear, Power and Polynomial of order 2.

Using the various models designed, we obtained different values for each of the regression/trendlines as shown in Table 2 with their respective percentage penetrations. It was observed that there is a significant increase in the subscriber base of fixed wireless access in Nigeria of over 120% for the three models with about 0.16%, 0.21% and 0.18% penetration for Linear, Polynomial and Power models respectively in 2000 as compared to the original subscriber data from Nigeria Communications Network (NCC) of 0.16% penetration. It followed an upward movement with about 1.24%, 1.21% & 1.23% penetration in 2006 and 1.83%, 1.87% & 1.81% penetration in 2011 respectively for Linear, Polynomial and Power model as compared to the original pecentage penetration of 1.27% and 1.78% for 2006 and 2011.

In 2012, Nigeria is expected to have about 1.95%, 2.01% & 1.93% penetration with subscriber base of about 3085389, 3186193, & 3052729 and by the year 2020 it would be at about 2.75%, 3.11% & 2.73% penetration with subscriber base of about 5012237, 5671354 & 4968840 respectively for Linear, Polynomial and Power models.

Using the result obtained from the models and the resultant percentage penetrations, it was found that the Linear Model was the most suitable to forecast the subscriber base of fixed wireless access in Nigeria from 2011 to 2020 and with the declaration of the Central Bank of Nigeria to introduce a cashless economy in Nigeria by June, 2012 and the efforts being put by the twenty four commercial banks in Nigeria to provide online banking, services such as internet banking, telephone banking, TV-based banking and mobile banking can be provided through the fixed wireless networks.

Table 2. Number of Subscriber of Fixed Wireless Network and their Percentage Penetration

YEAR	POPULATION	SUBSCRIBERS	% Penetration	LINEAR	% Penetration	POLYNOMIAL ORDER 2	% Penetration	POWER	% Penetration
2000	123,337,800	200,000	0.16%	195,117	0.16	256,042	0.21	225,499	0.18
2001	126,635,600	600,321	0.47%	435,973	0.34	463,665	0.37	455,964	0.36
2002	129,934,900	702,000	0.54%	676,829	0.52	677,935	0.52	688,342	0.53
2003	133,881,700	872,473	0.65%	917,685	0.69	898,851	0.67	921,971	0.69
2004	137,253,100	1,027,519	0.75%	1,158,541	0.84	1,126,414	0.82	1,156,534	0.84
2005	128,772,000	1,223,258	0.95%	1,399,397	1.09	1,360,623	1.06	1,391,844	1.08
2006	131,859,700	1,673,161	1.27%	1,640,253	1.24	1,601,479	1.21	1,627,778	1.23
2007	135,031,200	1,853,848	1.37%	1,881,109	1.39	1,848,981	1.37	1,864,247	1.38
2008	146,255,300	2,141,453	1.46%	2,121,965	1.45	2,103,130	1.44	2,101,184	1.44
2009	149,229,100	2,445,423	1.64%	2,362,821	1.58	2,363,926	1.58	2,338,539	1.57
2010	152,217,300	2,736,373	1.80%	2,603,677	1.71	2,631,368	1.73	2,576,270	1.69
2011	155,215,600	2,762,047	1.78%	2,844,533	1.83	2,905,457	1.87	2,814,342	1.81
2012	158,196,600	N/A	N/A	3,085,389	1.95	3,186,193	2.01	3,052,729	1.93
2013	161,183,510	N/A	N/A	3,326,245	2.06	3,473,575	2.16	3,291,406	2.04
2014	164,170,420	N/A	N/A	3,567,101	2.17	3,767,604	2.29	3,530,353	2.15
2015	167,157,330	N/A	N/A	3,807,957	2.28	4,068,279	2.43	3,769,552	2.26
2016	170,144,240	N/A	N/A	4,048,813	2.38	4,375,601	2.57	4,008,987	2.36
2017	173,131,150	N/A	N/A	4,289,669	2.48	4,689,569	2.71	4,248,645	2.45
2018	176,118,060	N/A	N/A	4,530,525	2.57	5,010,184	2.84	4,488,513	2.55
2019	179,104,970	N/A	N/A	4,771,381	2.66	5,337,446	2.98	4,728,582	2.64
2020	182,091,880	N/A	N/A	5,012,237	2.75	5,671,354	3.11	4,968,840	2.73

4. Policy Recommendations

The immediate role government needs to play are given in form of policy recommendation as follows:

1). Infrastructure:

Irrespective of the progress in the telecoms industry, low deployment of telecoms infrastructure in the country has limited the growth of information technology. Government should provide a policy that will improve the deployment of telecoms infrastructure in the rural communities to close the communication divide between the rural areas and urban areas.

2).Compliance:

Government should enforce a task-force/team (Nigerian Communications Commission) to monitor the compliance to the equal deployment of these telecoms infrastructures to the six geo-political zones in the country.

3). Empowerment:

With this in place, the citizens can benefit from empowerment programs like schooling, business, health through e-learning, e-transaction, e-medicine respectively. These will bring about increase in knowledge base of the citizens and a fast transfer of information of Nigerians on the world trend; this will help the country in its pursuits to vision 20:2020.

4) .Security:

Government should provide adequate security to secure these telecoms infrastructure in the country against theft from robbers and vandalism from angry youth of the host communities.

5. Conclusions

By improving the fixed wireless infrastructure in the rural areas it would help to:

- Improve the provision of e-services including e-government, e-education etc. that would help improve the infrastructural capabilities of the rural areas.
- Reduce rural-urban migration by providing improved infrastructure in the rural areas to aid development.
- Improve the standard of Living in the rural areas.

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