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Network Infrastructure Sharing and Efficient Utilization of Telecoms Infrastructure for Telecom Operators in Benue State

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Key words: *Bulk density, Environmental factors, Forest biomass, Precipitation, Soil organic carbon, Soil respiration*

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Key words: *Efficiency, network infrastructure, telecom operators, Nigerian Tele communication Commission*

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1. Introduction

There is a growing need for operators and providers in the Nigerian telecoms industry to drive down cost of capital assets or infrastructure deployed for telecom services. This has been expressed in recent times by many operators who now come together, on basis of

mutual agreements, to consider sharing infrastructure. The telecom market in Nigeria is driven by growing demand for telecommunications services like voice, SMS, data services like internet, fax, etc. as well as high broadband services like video calling, video messaging and video conferencing (Mansell, 1988).

Altogether, the transition from a voice to a data centric business is challenging for operators and it has forced them to launch efficiency programs, cut operational expenditures, reduce headcount, and reduce network operation costs. It is no exaggeration to state that cost cutting have become an inevitable part of the operator business and potentially paving the way for more radical measures that could re-shape the industry. A response to this development has been a growing number of network sharing agreements between operators. The development of network sharing is global and the current usage of network sharing could broadly be grouped into three categories: 1) agreements between operators to share parts or even entire networks, 2) to establish separate network companies that operate on behalf of their owners, and 3) independent infrastructure companies which, primarily, are doing tower and passive infrastructure sharing, but it could also be outsourcing where operator use external partners to run their networks (Chanab, El-Darwich, Hasbani and Mourad, 2007). Network sharing has become an inevitable part of the telecom industry and it raises questions which address a broad range of issues that are critical for operators, equipment manufacturers, regulators and consumers.

The regulatory body in Nigeria, Nigeria Communications Commission (NCC), has also given its backing to co-location initiative by providing the legal and technical guidelines that would ensure fairplay and enhance fair competition (Li and Whalley, 2002). NCC developed a regulatory framework for potential co-locatees to share infrastructure in order to promote fair competition and promote infrastructure sharing amongst telecoms licensees.

Indiscriminate installation of towers in Benue State has congested the skyline of the cities in the State with towers. There have been several calls by residents in Benue State for a ban to be placed on the mounting of towers. However, these masts form a necessary infrastructure that telecom operators need in order to carry signals that are necessary for communication to take place.

The main objective of this study is to explore if network infrastructure sharing results in an improved efficiency in the utilization of telecoms infrastructure for telecom operators in Benue State.

2. Literature Review

2.1. Theoretical Framework

i. Twice Cost-Sharing Theory (Secondary)

Based on the sharing theory of the separable costs and inseparable costs, one of important rules of twice cost-sharing is that, the costs enterprises participated need to bear should not lesser than the increased costs caused by these enterprises participating in building jointly (Forge and Blackman, 2006). And the increased costs are defined as separable costs

of these enterprises; the remaining costs are inseparable costs. In practice, the calculation of separable costs is simple, but the calculation of inseparable costs is difficult.

ii. Nash Negotiation Theory

It mainly reflects the process of bargaining of all the players in the cooperative process. The representative study of Li Yongjun (2008), researches fixed cost-sharing with bargaining game method. Chanab, El-Darwich, Hasbani, and Mourad, (2007) proves that, if cost-sharing is looked as a new input, there are some sharing schemes which can meet the collective reason of organization and the individual reason of decision-making units within the organization in the performance assessment. On this basis, the only sharing scheme is given by introducing bargaining game model. Finally, it takes the actual examples to prove that the theory is effective. Although Nash Negotiation meets the collective reason of alliances and the individual reason of enterprises, as the enterprises participated continue to bargain, the stability of alliances is poor.

2.2. Conceptual Framework

i. Spectrum Sharing

This concept, also known as spectrum trading , is a model that has recently developed in mature, regulated environment and it entails an operator leasing part of its spectrum to another operator on commercial terms. Since spectrum is a scarce that is often under-utilized by one operator in a given location, sharing proves a viable option for two or more operators (Chanab, El-Darwich, Hasbani and Mourad, 2007).

ii. National Roaming (Geographical Splitting)

Mandatory national roaming is a form of infrastructure sharing that allows new operators, while thier networks are still being deployed, to provide national service coverage by means of sharing incumbents' networks in specific areas (Oliver, 2007). While national roaming is generally introduced with a sunset clause, it could be made permanent in specific locations. National roaming accelarates competition by allowing new players to launch their services within shorter time frames (Chanab, El-Darwich, Hasbani and Mourad, 2007).

iii. Tower Companies

The growth of existing tower management companies have also helped to ease out problems of infrastructure. The business model consists of acquiring wireless infrastrcuture for operators and managing it (Park and Russo, 1996). The economics are strongly driven by colocation of operators on sites. Tower management comapnies usually enjoy scalable and long-term recurring revenues with contracted annual escalations. They also benefit from low churn rates and low operating and capital costs. Tower management companies thus can ensure fair treatment of new entrants while providing financial benefits to the incumbents by buying the latter's infrastrcuture and managing it, hence lowering operating expenses in the long run (Chanab, El-Darwich, Hasbani and Mourad, 2007). An example of this is Helio Towers Nigeria, Huawe, Alcatel, the company that provide wireless operators in Nigeria with fully-managed tower sites on a lease basis.

2.3. Telecoms infrastructure sharing models on the Africa continent

It is believed that Telecommunications tower sharing may very well be the next pot of gold in Africa's telecom industry. The Industry watchers believe that as the sector continues to grow, infrastructure requirements and demand will also grow. This high demand will then

be solved by co-location which will save operators millions of dollars in capital and operational expenditure over the years (Delaere and Ballon, 2003).

Coming out of dealing with unreliable contractors, it was hardly surprising that mobile operators did not trust others to do things like provide network infrastructure for them. So a number of mobile operators have poured money into acquisitions and fiber network roll-out. Although the concept of infrastructure sharing is new in Africa, the potential is enormous.

A 2008 report by International Telecommunication Union (ITU) urged governments to create the right regulatory framework to encourage and allow operators to engage in infrastructure sharing. It is also urged governments to identify market failures and those areas that could benefit most from infrastructure sharing. Also, in 2007, ITU's global symposium for regulators focused on infrastructure sharing in order to raise awareness and to highlight regulatory possibilities, technicalities and advantages. But 2010 will probably go down as the year when many of Africa's telecommunications companies realised that it was not possible to dominate the national or international fiber space in Africa. It is just too big and will cost too much. Infrastructure sharing then comes to the rescue (Alcatel-Lucent, 2010).

In Nigeria, Africa's current biggest telecom market, for instance there is the need of over 10,000 additional masts to address network expansion. These masts will cost more than $2.5 billion. With co-location, this high cost will be greatly reduced. At the moment, there are 11 companies with co-location licenses in Nigeria. Capital requirement is $250,000 per tower/mast and local banks have offered to support the idea by helping to provide finance (Markendahl, 2011). Also in Tanzania, the national regulator allowed Zanzibar Telecom Ltd (Zantel) to provide a mobile service to the mainland from its base in Zanzibar using Vodacom Tanzania's mobile network. This has lowered costs for Zantel's subscribers on Zanzibar who travel to the mainland and also provided mainland users with additional competition.

In addition to cost savings, another motive for infrastructure sharing relates to environmental concerns. The Nigerian Communications Commission has issued guidelines on shared infrastructure stating that one aim is to protect the environment by reducing the proliferation of infrastructure and facilities installations (International Telecommunication Union, 2004).

In many African countries, a lack of cooperation among operators has resulted in a proliferation of backbone transmission infrastructure. Two consequences of this are that, nationwide connectivity has often been neglected as the networks often consist of bits and pieces clustered around urban areas, and that in many instances; backhaul infrastructure is just microwave and not higher capacity fiber optic.

3. Methodology

3.1. Research Design

This study uses a combination of descriptive, correlation and cross sectional type of research. The descriptive aspect refers to that objective of systematically describing the concept of infrastructure sharing and the possible benefits that can be derived from it. The correlation aspect refers to that objective of discovering or establishing the existence of a

relationship/ interdependence between two or more variables relating to telecommunication infrastructure sharing such as extent of indulgence vis a vis cost savings. The cross sectional aspect refers to observation of sample subjects done at different points in a short period of time.

3.2. Population and Sampling Procedure

The study respondents consists of senior technical, rollout managers, finance/accountant and adminstrative staff cadre of MTN and GLO working in Benue State. The population of this category of staff in GLO is 120, while MTN is 170, making a total of 290 respondents. Through Yamane (1967) sampling technique, the sample size is 168.

3.3. Data Analysis Techniques

The researcher provides an exposition on the methods used to measure and analyze data for each study objectives and hypotheses. Multiple-Regression is a multivariate statistical technique which helps to predict one variable from other variables, as long as there are established relationships between the variables (Nworuh, 2004). The variable being predicted is usually known as dependent variables because its values are dependent on the other variables referred to as the independent variables.

4. Results and Discussion

4.1. Presentation and Analysis of Data

4.1.1. Network infrastructure components sharingMicrowave radio equipment

Majority of the respondents (42.7%) were neutral that their GSM companies help to reduce cost on customers by sharing their microwave. A large percentage, 18.3%, of the respondents agreed to this fact, while 15.9% did not agreed at all. A lesser percentage (13.4%) of the respondents strongly agreed, while, an uninspiring percentage (9.8%) strongly disagreed. The weighted average for this group was 2.13.

i. **Your Shelters are very important in reducing operational expenditure:** Most of the respondents (37.8%) were neutral that shelters are very important in reducing operational expenditure. A large percentage of 20.7% of the respondents agreed to this fact, while 18.3% did not agree at all. A lesser percentage (15.9%) of the respondents strongly agreed, while, an uninspiring percentage (7.3%) strongly disagreed. The weighted average for this group was 2.30.

ii. **You have sufficient switches:** Majority of the respondents (34.1%) is neutral that their GSM companies have sufficient switches. A large percentage of 22.0% of the respondents agreed to this fact, while 18.3% strongly agreed. A lesser percentage (13.4%) of the respondents strongly disagreed, while, an uninspiring percentage (12.2%) disagreed. The weighted average for this group is 2.30.

iii. **Electric supply:** Majority of the respondents (37.8%) were neutral that there is efficient electric supply. A large percentage of 22.0% of the respondents disagreed to this fact, while 15.9% strongly disagreed. A lesser percentage (17.1%) of the respondents agreed, while, an uninspiring percentage (7.3%) strongly agreed.

iv. **Your antennas are reliable in hosting other GSM networks equipment:** Majority of the respondents (43.9%) were neutral that their GSM companies have reliable antennas for hosting competitors. A large percentage of 18.3% of the respondents disagreed to this fact. Two sets of respondents to a certain percentage (12.2%) both strongly agreed and agreed to this fact, while an uninspiring percentage (13.4%) strongly disagreed. The weighted average for this group was 2.10.

v. **You have reliable easements:** Most of the respondents (29.3%) were neutral that their GSM companies have reliable easements for sharing. A large percentage of 23.3% of the respondents disagreed to this fact, while 19.5% strongly disagreed. A lesser percentage (17.1%) of the respondents agreed, while, an uninspiring percentage (11.0%) strongly agreed. The weighted average for this group was 1.99.

vi. **Your transreverts are relevant for improving quality of service:** Most of the respondents (25.6%) were neutral that their GSM companies have relevant transreverts for improving quality of service. A large percentage of 26.8% of the respondents disagreed to this fact, while 19.5% strongly disagreed. A lesser percentage (15.9%) of the respondents agreed, while, a lesser percentage (12.2%) of the respondents agreed. The weighted average for this group was 1.97.

vii. **Your ducts are better than other GSM networks:** Most of the respondents (34.1%) were neutral that their companies often make promises to potential customers through advertisement. A considerable percentage (22.0%) of the respondents agreed to this fact, while 18.3% strongly agreed. A lesser percentage (13.4%) of the respondents strongly disagreed, while, an uninspiring percentage (12.2%) disagreed. The weighted average for this group was 2.30.

4.1.2. Cost optimization strategy

i. **Network infrastructure components sharing help to improve the efficiency of operations:** Most of the respondents (25.6%) were neutral that a network infrastructure component sharing helps to improve the efficiency of operations. A considerable percentage (26.8%) of the respondents disagreed to this fact, while 17.1% strongly agreed. A lesser percentage (14.6%) of the respondents strongly disagreed, while, an uninspiring percentage (11.0%) agreed. The weighted average for this group was 2.08.

Table 1: Summary of Data Presentation

S/N	Statement	SA	A	N	D	SD	Weighted Average
(I)	**Network Infrastructure Components Sharing**	5	4	3	2	1	
(i)	Your microwave radio equipment helps in reducing the cost on customers	22 (13.4)	30 (18.3)	70 (42.7)	26 (15.9)	16 (9.8)	2.13

(ii)	Your shelters are very important in reducing operations expenditure	26 (15.9)	34 (20.7)	62 (37.8)	30 (18.3)	12 (7.3)	2.30
(iii)	You have efficient switches	30 (18.3)	36 (22.0)	56 (34.1)	20 (12.2)	22 (13.4)	2.30
(iv)	Efficient electric supply	6 (7.3)	14 (17.1)	31 (37.8)	18 (22.0)	13 (15.9)	2.00
(v)	Your antennas are reliable in hosting other GSM network's equipment	20 (12.2)	20 (12.2)	72 (43.9)	30 (18.3)	22 (13.4)	2.10
(vi)	You have reliable easements	18 (11.0)	28 (17.1)	48 (29.3)	38 (23.2)	32 (19.5)	1.99
(vii)	Your transreverts are relevant for improving quality of service	20 (12.2)	26 (15.9)	42 (25.6)	44 (26.8)	32 (19.5)	1.97
(viii)	Your ducts are better than the other GSM networks	30 (18.3)	32 (22.0)	56 (34.1)	20 (12.2)	22 (13.4)	2.30
(II)	**Cost optimization strategy**	5	4	3	2	1	
(ii)	Network infrastructure components sharing helps to improve the efficiency of your operations	28 (17.1)	18 (11.0)	50 (30.5)	44 (26.8)	24 (14.6)	2.08

Source: Field survey, 2014

Note: values in parenthesis are in percentages, 5 = Strongly Agreed [SA], 4 = Agreed [A], 3 =Neutral [N], 2 = Disagree [D], 1 = Strongly Disagree

4.2. Test of Hypothesis (H_0)

Network infrastructure sharing does not results in an improved efficiency in the utilization of telecoms infrastructure for telecom operators in Benue State. The t-calculated values: (2.854, 2.251, 4.711, 2.635, 2.193, 2.102, 3.834 and 4.205) for microwave radio equipment, shelters, switches, electric supply, antennas, easements, transreverts and ducts were significant, because they are greater than the t-tabulated value (1.98) (see Table 2). The F-calculated value of 35.315 was greater than the F-tabulated value of 2.00 and showed significance between the output and input variables. However, the (n-k, k-1), where, n=the sample size, k=the number of variables in the regression model. Thus (164-9, 9-1) = (156, 8), at a 5% significant level. The null hypothesis was rejected and the alternative hypothesis ($\mathbf{H_1}$) accepted, which states that, *"Network infrastructure sharing aids improved efficiency in the utilization of telecoms infrastructure for telecom operators in Benue State."*

Table 2: Network infrastructure sharing and improved efficiency in the utilization of telecoms infrastructure for telecom operators in Benue State.

Coefficients[a]

	Unstandardized Coefficients		**Standardized Coefficients**		
Model 2	**B**	**Std. Error**	**Beta**	**T**	**Sig.**

(Constant)	0.336	0.258		1.306	0.195
Microwave radio	0.201	0.071	0.246	2.854*	0.005
Shelters	0.178	0.079	0.198	2.251*	0.027
Switches	0.385	0.082	0.426	4.711*	0.000
Electrical supply	0.154	0.058	0.178	2.635*	0.010
Antennas	0.199	0.091	0.230	2.193*	0.030
Easements	0.183	0.084	0.217	2.102*	0.039
Transreverts	0.258	0.093	0.389	3.834*	0.023
Ducts	0.314	0.054	0.351	4.205*	0.000

a. Dependent Variable: Efficiency in the utilization of telecom infrastructure, *Correlation is significant at the 0.05 level (2-tailed), F-Calculated value = 35.315at 0.05, R = 0.794, R^2 = 0.630.

Source: SPSS print out 2014

4.3. Implications of the Regression Results

From Table 2, the multiple coefficients of correlation (R) was 0.794; meaning that there was a strong relationship between relationship between efficiency in the utilization of telecom infrastructure and cost reduction. The multiple coefficient of determination (R^2) on the other hand was 0.630 indicating that 63% of efficiency in the utilization of telecom infrastructure was caused by a variation of microwave radio equipment, shelters, switches, electric supply, antennas, easements, transreverts and ducts.

5. Conclusion and Recommendations

5.1. Conclusion

Indiscriminate installation of towers in Benue State has congested the skyline of the cities in the State with towers. There have been several calls by residents in Benue State for a ban to be placed on the mounting of towers. However, these masts form a necessary infrastructure that telecom operators need in order to carry signals that are necessary for communication to take place. The main objective of this study is to explore if network infrastructure sharing results in an improved efficiency in the utilization of telecoms infrastructure for telecom operators in Benue State. This study uses a combination of descriptive, correlation and cross sectional type of research. The study respondents consists of senior technical, rollout managers, finance/accountant and adminstrative staff cadre of MTN and GLO working in Benue State. The population of this category of staff in

GLO is 120, while MTN is 170, making a total of 290 respondents. Through Yamane sampling technique, the sample size is 168. Multiple-Regression is a multivariate statistical technique was used to predict one variable from other variables, as long as there are established relationships between the study's variables**.**

The study has shown that both CAPEX and OPEX have been reduced, operators were able to extend their coverage to reach more subscribers in the grassroots areas. Not only is the cost of rollout reduced but also the time to rollout. Tower sharing also benefits the environment by reducing unnecessary duplication of masts and their associated infrastructure, thereby causing better city aesthetics. However, the study concludes that "Network infrastructure sharing leads to an improvement in the usage efficiency of telecoms infrastructure for telecom operators in Benue State".

The study found out that the weighted averages for network infrastructure component sharing variables lay between the ranges of 1.97 – 2.30. The most weighted averages to the list is as follows: ii) shelters, iii) switches, and viii) Ducts =2.30, vii) microwave radio equipment = 2.13, v) Antennas = 2.10, vi) Easements = 1.99, and lastly vii) Transreverts = 1.97.

In the case of cost optimization strategy variables, the weighted averages range from 1.96 – 2.23. The most weighted averages to the list are as follows: iii) reduction in operational expenditure = 2.23, ii) Efficiency = 2.08, iv) quality of service = 2.00, i) cost reduction = 1.97, v) competitive advantage = 1.96.

This range in weighted averages extrapolated from the research questionnaire, implies that the respondents from MTN and GLO were conscious of the subject matter and have agreed to a certain degree that network infrastructure components sharing variables are important for cost optimization strategy. However, most of the respondents answered towards the middle of the likert-like scale range of *"considerable degree (C),"* which emphasizes the need for improvement.

5.2. Recommendations

From our conclusion, the study came to the following recommendations for stakeholders:

i. The telecom regulatory body (NCC) should encourage infrastructure sharing trends in Benue State by ensuring that terms of agreement are adhered to by both parties and ensuring that defaulting parties are penalized in forms of fines or surcharges. This would ensure better commitments by the colocating parties.

ii. The NCC should eliminate the issues of non-harmonization of standards in specifications among telecom operators through issuing colocation licenses to third party companies who would be allowed to maintain or build infrastructure as separate companies desiring to share infrastructure. Hence, such issues as lack of commitment from the other party towards taking care of equipment belonging to the other will be eliminated.

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APPENDIX I: Questionnaire Distribution and Retrieval

S/N	Group	Number Administered	Number Retrieved	Acceptance Number	% of Success
	Total	168	164	164	97.6

Source: Field survey, 2014