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THE EFFECTS OF COLOCATION ARRANGEMENT ON COST EFFICIENCY OF SELECTED GSM FIRMS IN NIGERIA

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ABSTRACT

This research work focused on the effects of Collocation arrangement on Cost Efficiency of selected GSM firms in Nigeria. The sources of data for this research work were exclusive primary data sources. Primary data sources for this research work were obtained from structured and standardized copies of questionnaire targeted to 200 respondents. The respondents were professionals or stakeholders in the area of the research interest. Data collected were subjected to multiple regression analysis. On the basis of the multiple regression output, a relationship model was estimated. It was found from the results of the study that colocation arrangements as a whole and (or) individually has significant effect of cost efficiency. This significance was attributed to the following aspects of colocation arrangements: security arrangement and spectrum sharing arrangement. Other colocation arrangements such as Network operations arrangement, Core Network arrangement and Human resources arrangement were significant. We therefore make the policy recommendations: (i) the Regulatory body (NCC) should standardized the telecommunication system platforms in Nigeria (ii) Elimination of the monopolistic behaviours by the regulator (iii) Granting of more colocation licenses to third party companies (iv) the colocatees should jointly secure sites (v) the colocatees must provide adequate maintenance culture with regard to hardware and software resources (vi) Effective and efficient training and re-training programmes be organized for their staff. We then conclude that when these policies are put in place the following will be the benefits in the telecom sector: (i) Reduction in negative environmental and health hazards (ii) Optimization in the use of scarce national resources (iii) Shift in focus to service-based innovation instead of network deployment (iv) Releasing of capital for strategic investments (v) Decrease in the barriers to market entry for new entrants.

Keywords: Colocation, Telecomms, Data, Cost efficiency, Respondents, Network Infrastructure

INTRODUCTION

The growth of the telecoms market in Nigeria has continued to expand at geometric rates thereby sustaining the market as one of the fastest growing telecom market globally is a task. This growth however has brought with it a huge cost burden on telecom investors and operators as they continue to expend huge capital expenditures on telecom assets and infrastructure in a bid to gain and sustain competitive advantage. The concept of colocation involves the sharing of resources among competing investors on the same site (or location), and this concept is practiced in the telecomms business (Bala-Gbogbo, 2009; Chaudhry, 2007). Today, as the telecom market in Nigeria nears maturity, the average revenue per user (ARPU) and revenue-on-assets (ROA) indices begin to dip, telecom operators in Nigeria are beginning to desperately explore new ways of reducing their capital expenditures (CAPEX) and operational overheads / cost (OPEX) on telecom infrastructure. Presently, key players in

the Nigerian telecom industry are now resorting to sharing network infrastructure as a strategy to achieve substantial reduction in their CAPEX and OPEX burden and hence, be able to survive and realize better returns on their investments (World Bank, 2008).

Also, the Nigerian Communications Commission (NCC) has given its support to this new model and has also developed a regulatory framework for potential colocatees to share infrastructure in order to promote fair competition and promote infrastructure sharing amongst telecom licensees (NCC, 2004; 2006; 2008). Sharing of telecommunication infrastructure among telecom service providers is becoming the requirement and process of business in the telecoms' industry where competitors are becoming partners in order to lower their increasing investments cost (MCI, 2009; Kuropatwa, 2009; Bhanu, 2007). The degree and method of infrastructure sharing can vary in each country depending on regulatory and competitive climate. The question being asked in the developed world is whether the developing countries like Nigeria can harness and sustain the telecommunication boom. The high cost of building telecom infrastructure in view of expansion and market entry remains a major concern in the industry in Nigeria (Emeka, 2009). The growth in this sector is dramatic and the trend is aggressively on the upwards swing. With the improved performance in the communication sector in the last thirteen (13) years, there is a widespread optimism among participants in this sector of a brighter future for business outlook. Current statistics on communication services appear to support the optimism expressed by the participants.

STATEMENT OF THE PROBLEM

The unrestricted incidences of masts and towers all over Nigeria are partly due to the failure of the Nigeria Telecommunication Limited (NITEL) to live up-to its duties and responsibilities in the telecom sub-sector in over 45 years of her existence. The situation has left players in the sub-sector to literally fend for one another. They build their own telecom infrastructure including the construction of masts, towers, signal relays, repeaters and cell sites

Since telecom infrastructure of whatever sort is capital intensive from a business point of view, it becomes more difficult for Information and Communication Technology (ICT), Public Telecommunication Operations (PTOs) and Global System for Mobile Telecommunication (GSM) companies in Nigeria to operate profitably and making expansion plans towards meeting

Subscribe' growth even more difficult. There is also the constraint in getting approval from Local Government Authorities (LGA) and State Government (SG) in the laying of transmission links such as cables and fibre and building communication towers in their domain (Francis, 2001; Booz Allen Hamilton, 2007). Hence, telecom operators are encouraged to share infrastructure as a means of avoiding unnecessary duplication of infrastructures. Savings achieved via infrastructure sharing could be used to employ better staff, improve network service and introduce value added service and product offerings that would lead to new streams of revenue generation (Chanab, 2007; Hussain, 2009). This project work looked into solving the following problems:

1. The problem of high cost of network infrastructure rollout and capacity expansions by telecom operators in Nigeria (FGN, 2004).
2. The problem of inefficient and ineffective usage of telecom infrastructure by telecomm operators in Nigeria (Frost and Sullivan, 2008).
3. The problem of high cost of operational expenditures (OPEX) dissipated by telecom operators in Nigeria.

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4. The problem of poor quality of service and security (Ericsson, 2004)

OBJECTIVE OF THE STUDY

The central objective of the study examined the effect of colocation arrangement on cost efficiency of selected GSM firms in Nigeria. The specific objectives of the study are as follows:

1. Identify various aspects of colocation
2. To examine the collective effect of all aspects of colocation on achieving cost efficiency
3. To examine the individual effect of each aspect of colocation on achieving cost efficiency
4. To make policy recommendations based on the findings of the study

RESEARCH QUESTIONS

Based on the statement of the problem, the objectives of the study and the researcher pose the following questions:

1. To what extent do the collective aspects of colocation affect cost efficiency of GSM firms in Nigeria?
2. To what extent does individual aspect of colocation affect cost efficiency of GSM firms in Nigeria?

RESEARCH HYPOTHESIS

On the basis of the statement of problem, objectives of the study and research questions, the following hypothesis have been formulated:

Ho_1: the collective aspects of colocation arrangement among GSM firms in Nigeria have no significant effect on cost efficiency.

Ho_2: the individual aspect of colocation arrangement among GSM firms in Nigeria has no significant effect on cost efficiency.

SIGNIFICANCE OF THE STUDY

There is a growing need for GSM operators and providers in the Nigerian telecommunication industry to drive down cost of capital assets or infrastructure deployed for telecom services (Motorola, 2006). This has been expressed in recent times by many operators who now come together on the basis of mutual agreements to consider sharing infrastructure. The telecommunication market in Nigeria is driven by growing demand for telecom services like voice, SMS, data services like internet, fax etc as well as high broadband services like video calling, video messaging and video conferencing (CIPESA, 2006; Hindu, 2007). This research study was aimed at determining the effect of colocation arrangement on cost efficiency of selected GSM firms in Nigeria. The research was based on a case study analysis of the current colocation arrangement between MTN Nigeria Ltd and Airtel Nigeria Ltd (MTN, 2008). The study seeks to explore the benefits of the infrastructure sharing deal between these two companies as well as recommend an improved or enhanced framework or model to sustain this strategy model in the context of the Nigerian telecom industry. The research work relied on data collected using questionnaires. The findings of the research work will help GSM operators to face and solve challenges that include theft and vandalisation of equipment as well as pressure from authorities to reduce the number of towers scattered all over the country.

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RESEARCH METHODOLOGY

This research work was based on a well structured method using standard empirical tools. The research design comprised of combination of descriptive, exploratory and causal approaches. This was because the concept of telecom infrastructure needs to be clarified, and existing models explored in order to investigate the causal relationships that exist among the variables under study.

It consists of both qualitative and quantitative methods of data collection and empirical analysis was employed. Again, this was due to the nature of variables and context being investigated. The researcher employed a case research approach as the method is particularly well suited for this research thesis since the phenomenon under investigation was difficult to study outside its natural context and also the concepts and variables under scrutiny are difficult to a large extent to quantify. The researcher make use of standard model and assumptions based on previously tested theories in Western and other telecommunication market, the research involved a deductive approach to drawing or making conclusions based on hypotheses drawn from studying existing literature. This research work refers to the use qualitative and field-based construction techniques; and analysis of business cases. The case study research will hence, involve data collection through multiples sources such as questionnaires, verbal reports, personal interviews, focus groups, electronic observations as primary data sources.

Research Design

This emphasized that a good research design will ensure that collected data is consistent with the study of the objectives in addition to being accurate and economical. Functions of the research design include:

a. Demand for answers to questions among relationship among variables
b. Increased certainty and generalization of results.

As a field of survey, this research work focus on the colocation arrangement among GSM firms in Nigeria and see how such arrangement affect cost efficiency. Data for analysis for this work was exclusive primary data with no attempt was made to include secondary data. The study followed objectivity in the identification of aspect of colocation that affects cost efficiency on the basis of literature review. The above imply that some aspect of colocation (variables or factors) are identified through literature review and analyzed to see how it affect (whether positive or negative) cost efficiency of GSM firms in Nigeria. The field survey approach was adapted for data collection based on specific application area such as:

a. Core Network
b. Network operations
c. Human Resource
d. Spectral sharing
e. Security

In this study, the researcher developed a well-structured and standardized questionnaire on perceived aspect of colocation that affect cost efficiency of GSM firms in Nigeria based on the Likert five-point ordinal scale and they were administered to staff, experts, users, systems analysts, programmers and other stakeholder in the domain of study. The respondents possess technical skills, academic qualification and experience in colocation arrangement of GSM operations in Nigeria. A total two hundred (200) copies were distributed.

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Method of Data Collection

This section deals with means and techniques through which data was collected for this research thesis. The primary data (copies of questionnaire) collected here were meant for testing and validating the prior hypotheses postulated through literature review which was the secondary source of data. The Nigerian telecommunication sector is made up more than twelve (12) telecommunication operators constituting of mobile and fixed private operators. The mobile GSM sector is made up of five (5) operators of which colocation relationship exists mainly between two (2) dominant operators namely, MTN and Airtel. Hence, this colocation arrangement between these two has been selected as a case study. A random sampling strategy was employed; the researcher visited the operators (MTN and AIRTEL).

This sampling method is representative of the entire population of GSM mobile operators in Nigeria seeing that MTN has 49.19% of the mobile market share, while Airtel has 24.74%. This research thesis is case study based and the single case reviewed is the colocation / infrastructure sharing pact that is being currently undertaken by MTN Nigeria and Airtel Nigeria. Both companies constitute 40% of the total number of mobile operators in Nigeria. Both telecommunication companies have undertaken to share infrastructure under a mutual agreement called colocation which has the Nigerian Regulatory Authority's backing. This is as a result of the nature of information / data being sought as certain sections required fixed responses and others were open-ended questions allowing the respondent(s) liberty to discuss his opinion on the problem area and subject matter. Primary data collection tools were used for this thesis. One form captures information concerning the respondent(s) and his experience in GSM colocation arrangement in Nigeria and the other form captures detail identification of the several aspects of colocation arrangement that affect cost efficiency. This form that captured data on aspect of colocation that affect cost efficiency and development was designed based on the Likert five-point scale. The Likert summated involves statement relating to attitude in question (Ghuari , P & Gronhaug, 2005).

The respondents are required to indicate the degree of agreement or disagreement with each of the statements. A numerical score is assigned to each degree of agreement / disagreement. The scores from the statement are added up to obtain the total score for each respondent. Example:

Table 1. Likert five-point table

Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

Source: Booz Allen Hamilton 2007

The use of Likert five-point as an attitude measuring scale is well justified for this study and is rigidly followed as described as listed below:

I. Responses were selected and subjected to scoring based on the judgmental assessment on the degree of how the various aspects of colocation affect cost efficiency of GSM firms in Nigeria.

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II. Favourable and unfavourable statements of how the aspects of colocation affect cost efficiency of GSM firms in Nigeria were compiled.

III. Collected statements in the form of a questionnaire were administered to a sample deemed to be reasonably representing the population being studied.

IV. Each respondent's score is obtained by adding up the scores of the responses to each statement.

These steps have been followed rigidly in obtaining data and opinion of respondents regarding aspect of colocation arrangement that affect cost efficiency of GSM firms in Nigeria. It argue that attitude are complex and difficult to measure, and that individuals tends to make inaccurate judgment under difficult circumstances, therefore a scale such as Likert, which improves the measurement of attitudes, is ideal and although, it can be used to rank attitude, but cannot be used to measure difference between attitudes. Also attitude vary respondents may obtain exactly the same score from agreeing with quite different items.

Method of Data Analysis

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 it values is dependent on the other variables variously referred to as the independent variables. In multiple regressions, the model describing the relationship between the dependent variable and independent variables is as given in the equation 1.1 below:

$$Y = +\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon_i \ldots\ldots \text{ equation 1.1}$$

Y = the dependent variable

Where $X_1, X_2 \ldots\ldots\ldots\ldots\ldots\ldots X_n$ = independent variables

β_0= a constant value of Y when all X values are 0.

$\beta_1 + \beta_2 + \ldots\ldots\ldots\ldots\ldots + \beta_n$ = net regression coefficients. For instance, β_0 measures the change in $X_{1\ldots\ldots n}$ while holding the other variables constant.

€ = independent and normally distributed random error term with mean zero.

For the purpose of this study, our

Y = Total cost

X_1 = Core Network aspect

X_2 = Network operations aspect

X_3 = Human Resource aspect

X_4 = Spectrum sharing aspect

X_5 = Security aspect

TEST OF HYPOTHESES 1 AND 2

Hypotheses 1 and 2 are to be tested using multiple regressions. In hypotheses 1 and 2 we shall make the Total collectives aspects of colocation have significant effect on cost efficiency and development of GSM operation in Nigeria (Y) as the dependent variable while the independent variables ($X_1 \ldots X_5$) will be:

X_1 = Core Network aspect

X_2 = Network operations aspect

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X_3 = Human Resource aspect

X_4 = Spectrum sharing aspect

X_5 = Security aspect

F-test is to be employed in testing the overall significance of the Model (independent variables taken together), while the T-test will be employed in testing the significances of each of the independent variables.

Test of Model Analysis of Variance (ANOVA)

ANOVA measures whether or not the equation represents a set of regression coefficients that, in total are statistically significant from zero. In multiple-regression, as in simple regression, the total deviation on each observation Y_i from the mean $(Y_i - Y)$ can be expressed as the sum of its explained and unexplained variations:

$$\sum(Yi - Y)^2 = \sum((Yi - Y)^2 + \sum(Yi - Y))^2 \ldots\ldots \text{ equation 1.2}$$

$$SST = SSR + SSE$$

Where

$(Y_i - Y)$ = Explained variables

$(Y_i - Y)$ = Unexplained variables

$$SST = \sum Y_i^2 - (Y)^2/n \ldots\ldots \text{ equation 1.3}$$

$$SSE = \sum Y_i^2 - \sum Y^2 = \quad SST - SSR \ldots\ldots \text{ equation 1.4}$$

Where

SST= Sum of square total

SSR= Sum of square due to regression

SSE= Sum of square due to error

The necessary sum of squares, degree of freedom, mean squares and variance ratio for multiple regressions are summarized in the ANOVA table 1 below:

Table 2. The ANOVA Analysis table

Source of variation	*Sum of squares (SS)*	*Degree of Freedom (df)*	*Mean Squares (MS)*	*Variance Ratio (F-ratio)*
Regression	SSR	K	MSR = SSR/K	F*= MSR/MSE
Error	SSE	n – k – 1	MSE = SSE/n-k-1	
Total	SST	N – 1		

Data Presentation and Analysis

Out of 200 survey questionnaires distributed, 186 copies were returned. The researcher screened the copies returned for incomplete or missing data. Questionnaires with mostly unanswered questions were discarded. After which we had 176 useable survey forms, which is equivalent to 88% response rate. Statistical Package (SPSS) was used to summarize and analyze the data. Frequencies for each demographic variable were computed (Santos, 1999; Nunnally, 1978).

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RESULTS

Table 3. Model Summary of the Constructs

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*	*Change Statistics*					*Durbin-Watson*
					R Square Change	*F Change*	*df1*	*df2*	*Sig. F Change*	
1	.659[a]	.435	.418	2.51576	.435	26.168	5	170	.000	1.863

Source: data gotten from QUESTIONNAIRE

The overall predictability of the model is shown in Table 3 above, it can be seen that the R-Square value for the model showed that 43.5 percent (R^2=0. 435) of the variance in the total cost can be predicted from the independent variables (core network aspect, network operations aspect, human resources aspect, spectrum sharing aspect and security aspect).

Table 4. ANOVA for the constructs

	Model	*Sum of Squares*	*Df*	*Mean Square*	*F*	*Sig.*
1	Regression	828.105	5	165.621	26.168	.000[a]
	Residual	1075.934	170	6.329		
	Total	1904.040	175			

Table 4, presents the ANOVA report on the general significance of the model. As p is less than 0.05, the model is significant. Thus, the combination of the variables significantly predicts the dependent variable (F=26.168; $p < 0.05$). It indicates that the model and data are well fit in explaining the effect of colocation arrangement on total cost and development of GSM firms. Therefore, colocation arrangement reduces overall cost, it is reasonable to focus on the improvement of the 5 aspects of colocation arrangement and see how the aspects will improve efficiency and development.

Table 5. Colocation Aspects and Total Cost Regression Analysis

	Model	*Un-standardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*	*Co linearity Statistics*	
		B	*Std. Error*	*Beta*			*Tolerance*	*VIF*
1	(Total cost)	5.872	1.323		4.438	0.000		
	Core network aspect	0.062	0.043	0.100	1.439	0.152	0.686	1.457
	Network operations aspect	0.046	0.042	0.077	1.080	0.282	0.659	1.518
	Human resources aspect	-0.033	0.060	-0.044	-.540	0.590	0.500	2.001
	Spectrum sharing aspect	0.109	0.057	0.154	1.923	0.056	0.516	1.936
	Security aspect	0.316	0.047	0.501	6.777	0.000	0.609	1.642

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Table 5, showed the un-standardized Beta Coefficients that present the contributions of each variable to the model. The t and p-values showed the impact of the independent variables on the dependent variable. From Table 5, it was clear that the Security Aspect had the highest impact on overall Total cost when colocated (the independent variable), achieving a ß of 0.316 (the large t-value and corresponding low p-value buttressed the result for Security Aspect which had the highest Beta coefficient (both for standardized and un-standardized)), followed by Spectrum sharing Aspect (ß= 0.109), Core network aspect (ß=0.062), Network operations Aspect (ß=0.046) and The last factor influencing Total cost when GSM firms colocate is the Human Resources Aspect (ß= -0.033). Results imply that increasing the quality of Core network aspect, Network operations aspect, Human resources aspect, Spectrum sharing aspect and Security aspect in colocated GSM environment will inherently reduce Total cost and improve efficiency and development.

$$\begin{aligned} Overall\ TOTAL\ COST \\ &= 5.872 + .062\ \text{Core network aspect} + .046\ \text{Network operations aspect} \\ &+ -.033\ \text{Human resources Aspect} + .109\ \text{Spectrum sharing aspect} \\ &+ .316\ \text{Security Aspect} \end{aligned}$$

The standardized beta coefficients in Table 5 can be interpreted that the independent random variables (Colocated Aspects) have strong effect on Total cost. Here, 100% change in Core network Aspect leads to 100% change in the level of Total cost, 100% change in Network operations Aspect leads to 77% change in Total cost level and 100% change in Human resource Aspect, Spectrum sharing Aspect and Security Aspect leads to -44%, 15.4% and 50.1% change in Total cost level respectively.

Table 6. Summary of Values for the Constructs

Variables	*Beta*	*P*
Core network Aspect	0.062	*P= 0.152 >0.05**
Network operations Aspect	0.046	*P=0.282 >0.05**
Human resources Aspect	-0.033	*P= -0.540<0.05**
Spectrum sharing Aspect	0.109	*P=0.056>0.05**
Security Aspect	0.316	*P=0.000<0.05**

Table 7. Summary of Hypotheses Analysis

	Hypothesis	*Results*
H_0	Core Network Aspect is positively related to Total cost	Significant
H_0	Network operations Aspect is positively related to Total cost	Significant
H_0	Human resources Aspect is negative related to Total cost of colocated GSM resources	Not Significant
H_0	Spectrum sharing Aspect is positively related to Total cost	Significant
H_0	Security is positively related to Total cost	Significant

DISCUSSION AND SUMMARY

This research explored the effect of colocation arrangement on cost efficiency and operations development of selected GSM firms in Nigeria. In addition it looked into the benefits of colocation of GSM firms resources as a means by which telecoms operators in Nigeria can optimise their capital and operating expenses. The results obtained clearly supported propositions in literature reviews that operators can obtain 30-40% savings on both their CAPEX and OPEX spending by deciding to share telecoms infrastructure with other operators. The results of the research also provided evidence that fears of network performance degradation due to telecoms site sharing will not be necessary since major issues of network degradation can be handled by simply synchronizing site maintenance schedules and each party taking responsibility for the other's equipment fault resolutions. It also proved that operators are able to achieve better competitive advantage through wider coverage in faster and cheaper ways by adopting infrastructure sharing in their business strategies.

Infrastructure sharing in telecoms was also seen as a catalyst for better product/service innovations and new product development depending on the company's marketing or sales strategy. However, many experts have wondered at the trend of unwillingness to share infrastructure by some telecoms operators in Africa. Hence, in Africa it is not uncommon to find three similar masts belonging to three different operators all crammed in the same 200 square metre area. It is also uncommon to find different telecom operators digging up roads in cities and along highways, each laying similar infrastructure, like fibre, to that of the other companies. This does not auger well with the environment for the African people as these several cutting of roads and plenty of masts or towers make the government spend more on road budgets as well as making the skyline very untidy. Colocation or infrastructure sharing can also help regulators achieve improved customer service as the financial gains achieved by operators can be used to maintain their good employees, and add value to their services. Hence, the following recommendations would be made using MTN-Airtel Colocation case study for policy makers and other operators as a way of encouraging the infrastructure sharing trend in Nigeria.

The overall predictability of the model is shown in Table 1 above, it can be seen that the R-Square value for the model showed that 43.5 percent (R^2=0. 435) of the variance in the total cost can be predicted from the independent variables (core network aspect, network operations aspect, human resources aspect, spectrum sharing aspect and security aspect).

Table 3, presents the ANOVA report on the general significance of the model. As p is less than 0.05, the model is significant. Thus, the combination of the variables significantly predicts the dependent variable ($F=26.168$; $p < 0.05$). It indicates that the model and data are well fit in explaining the effect of colocation arrangement on total cost and development of GSM firms. Therefore, colocation arrangement reduces overall cost, it is reasonable to focus on the improvement of the 5 aspects of colocation arrangement and see how the aspects will improve efficiency and development.

Table 5, showed the un-standardized Beta Coefficients that present the contributions of each variable to the model. The t and p-values showed the impact of the independent variables on the dependent variable. From Table 4, it was clear that the Security Aspect had the highest impact on overall Total cost when colocated (the independent variable), achieving a ß of 0.316 (the large t-value and corresponding low p-value buttressed the result for Security Aspect which had the highest Beta coefficient (both for standardized and un-standardized)), followed by Spectrum sharing Aspect (ß= 0.109), Core network aspect (ß=0.062), Network operations Aspect (ß=0.046) and The last factor influencing Total cost when GSM firms colocate is the Human Resources Aspect (ß= -0.033). Results imply that increasing the

quality of Core network aspect, Network operations aspect, Human resources aspect, Spectrum sharing aspect and Security aspect in colocated GSM environment will inherently reduce Total cost and improve efficiency and development.

CONCLUSION

The following conclusions have been drawn from the results of this research.

1. Network infrastructure sharing leads to significant reduction in cost of network infrastructure rollout and capacity expansions for telecoms operators in Nigeria.
2. Network infrastructure sharing leads to an improvement in the usage efficiency of telecoms infrastructure for telecom operators in Nigeria.
3. Network infrastructure sharing leads to significant savings in the operational expenditures (OPEX) dissipated by telecoms operators in Nigeria.
4. Network infrastructure sharing does not affect quality of service very adversely when properly managed by telecoms operators in Nigeria.
5. Network infrastructure sharing will enable telecoms operators in Nigeria achieve and sustain competitive advantage through wider coverage and capacity at less costs.
6. Network infrastructure sharing would lead to improved service delivery by telecoms providers in Nigeria.
7. Network infrastructure sharing can help telecoms operators in Nigeria achieve better competitive advantage through new product development and service innovations.

REFERENCES

Bala-Gbogbo, E (2009). Telecom Industry Operators Opt for Infrastructure Sharing. Retrieved on August 20, 2009, from http://www.234next.com/csp/cms/sites/Next/Money/Business/5418647/story.csp

Bhanu(2007). *Sharing of Telecom Infrastructure: Passive, Backhaul & Active*, November 2007, pp. 1 – 10.

Booz, A. H. (2007). *Infrastructure Sharing: Opportunities and Threats for MENA Telecom Operators*, Booz Allen Hamilton Consulting. Available from http://www.boozallen.com/news/29537171

Chaudhry, S. (2007). *Infrastructure Sharing in Telecom Networks – Indian Perspective*, Telecom Regulatory Authority of India, New Delhi,June 2006, pp. 1 -27.

CIPESA (2006). *The Case for Infrastructure Sharing in Africa*, Collaboration on International ICT Policy for East and Southern Africa. Retrieved on April 14, 2009 from http://www.cipesa.org/163

Chanab, L. A. et al., (2007). *Telecom Infrastructure Sharing: Regulatory Enablers and Economic Benefits*. Booz Allen Hamilton Consulting, December 2007, pp. 1 – 12.

Ericsson (2004). The Beauty of Network Sharing', Ericsson. Retrieved on October 26, 2009, from http://www.ericsson.com/solutions/news/2004/q1/20040202-network.shtml

Emeka, O. (2009). *Telecom Infrastructure Sharing as a Strategy for Cost Optimization and Revenue Generation*: A Case Study of MTN Nigeria/Zain Nigeria Colocation. MSc disertation.

FGN (2004). *National Policy on Telecommunications*, Federal Government of Nigeria, January 2004, pp. 1 – 35.

Frost & Sullivan (2008). *CAPEX in the African Telecommunications Market to Skyrocket*. Retrieved on October 26, 2009, from http://telecom.tekrati.com/research/9963

Francis (2001). *Telecommunication Cost Reduction in Nigeria through Infrastructure Sharing between Operators*. Francis E. Idachaba, Ph.D. Department of Electrical and Information Engineering, Covenant University, Ota, Ogun State, Nigeria.E-mail: idachabafe@yahoo.com Unpublished thesis.

Ghuari, P. & Gronhaug, K. (2008). *Research Methods in Business Studies*. London: Pearson Education.

Hussain, F. (2009). *Examining the Benefits of Infrastructure Sharing and How to Apply it Succesfully*. http://heliostowers.com/ , June 2009, pp. 1 -18.

Kuropatwa, H. (2009). *Network Sharing in LTE Deployment. It's a no brainer. Isn't it?*, Ventura Partners, October 2009, pp. 1 – 15.

Motorola. (2006). *Achieving Highly Effective Coverage in GSM Networks*. Motorola Reach White Paper. www.motorola.com/networkoperators

MCI. (2009). Vodafone and Telefonica Announce Wide Ranging Network Sharing Formular Deal for Europe. 2009. *Mobile communications International, Issue 158*. April 2009.

MTN. (2008). *MTN Group 2008 Final Audited Results for the Year ended 31 December 2008*, MTN Group, South Africa, pp. 1-22.

Nunnaly, J. (1978). *Psychometric Theory* (2nd Ed.). New York: McCraw-Hill.

Nworuh, G. E. (2004). *Basic Research Methodology for Researcher Trainers and Trainers in Management Sciences* (Second edition). Owerri: Ambix.

NCC. (2004). *Trends in Telecommunications Markets in Nigeria: 2003 -200*4, Nigerian Communications Commission. Retrieved on October 20, 2009, from http://www.ncc.gov.ng

Nigerian Communications Commission (NCC). (2008). *Guidelines for Colocation and Infrastructure Sharing*. Nigerian Communications Commission: Lagos, Nigeria.

NCC. (2006). *Determination of Interconnect Rate – Issued by Nigerian Communications Commission*, Nigerian Communications Commission, June 2006, pp. 1 – 31.

NCC. (2006). *Guidelines on Colocation and Infrastructure Sharing*, Nigerian Communications Commission, pp.1-13.

Santos, J. (1999). Eservice Quality: A Model of Virtual Service Quality Dimensions. *Managing Service Quality, 13*(3), 233-246.

The Hindu (2007). TRAI proposes sharing of telecom infrastructure. *The Hindu*, April 12, 2007.

World Bank (2008). *A Brief Introduction to Modeling for the Regulation of Transport Infrastructure,* World Bank, pp. 10 -15.