Assessment of Factors Affecting Quality of Service of Cellular Mobile Network Operators in Nigeria for the Period 2010 to 2014.

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ABSTRACT

Free competition and new network technology have increased competition and widened the range of network service available throughout the world. Unfortunately for cellular network service providers, loyalty is a rare trait among customers when it comes to choosing a particular mobile cellular system provider. Despite the huge financial commitment by companies into their respective communication technologies, users ultimately make decisions based on their perceived quality of service (QoS). It is the researcher's intention to identify the factors affecting the Quality of Service of cellular mobile network providers in Nigeria and put their effect in quantifiable terms. This study span for four years [2010-2014] and four leading telecommunication firms were selected to represent the entire telecommunication industry. These firms include MTN-Nigeria, Globacom, Etisalat and Airtel. The primary source of data used in this research work was questionnaire while the secondary source of data include data from; Nigeria communication commission(NCC), the above mentioned four communication firms as well as data from the researchers in related topical issues. The main quantitative approach used was regression analysis and for the easy of handling the volume of data, the use of statistical package for social sciences [SPSS] software was used. It was discovered that six factors affect the quality of service of cellular mobile network: Network coverage/ Availability of service(X_5), Call quality(X_3), Price of service (X_4) , Customer care(X_2), Diversity of bundle option of service (X_1) and Promotion/Offering of Incentive(X_6). A predictive model was derived as : $Y = 3.731 + 0.565X_5 + 0.440X_3 + 0.221X_2 + 0.189X_4 + 0.165X_1 + 0.097X_6$

Keywords: QOS, NCC, Telecommunication, Wireless, Cellular,

1.0   Introduction

Wireless communication technology has gained widespread acceptance in recent years. For instance, In the telecommunication industry a lot of services which are provided by the wired network have been supported by the wireless equipment. This fast and constant increase in the cellular market has left a huge imprint in all facets of human (day to day) life, such as social networking, healthcare, education, transportation and national security. With different network services, the demand for supporting multi-type traffic applications in wireless network has increased dramatically **(Yadav et al, 2013).** The different nature of the services implies particular quality requirements that need to be fulfilled in order to satisfy the end-user's expectations.

Unfortunately for network providers, loyalty is a rare trait among customers when it comes to choosing a particular mobile cellular system provider (an average mobile phone user in Nigeria patronizes two or more network service provider). Despite the huge financial commitment by companies into their respective communication technologies, users ultimately make decisions based on their perceived quality of service (QoS). As cellular technology continues to ingrain itself in all aspects of society, network providers must emphasize on delivering high quality of service to its end users. This is critical for any service provider to gain a sustainable competitive edge in the market. To remain competitive, network providers must understand and characterize customer's perception of the quality of service provided by their respective technologies.

Also, the concept of customer's satisfaction has received much attention in recent time. A company's most important success factor is the ability to deliver better customer value than competitors do, and the objective of quality of service assessment is to assist service providers to deliver value to their customers. It is a well known fact that consumer's perception of product quality is an important aspect of a purchasing decision and market behavior. This positive relationship of service quality with customer's satisfaction is proven in Danaher and Mattsson (1994) and Kim et al (2004), with customer's preference is proven in Ranaweera and Neely (2003), and competitiveness is proven in Rapert and Wren (1998). Thus, a high quality of service will guarantee maximum return on investment to the organization's shareholders and employees.

Several studies have been carried out in this area each isolating the individual quality of service factors and the influence on quality of service of cellular mobile network. However, this is not objective enough as there is need to investigate collective effects of the combined factors on the quality of service. In view of these challenges, this current work is geared towards assessing closely the factors influencing quality of services of the cellular mobile operators in Nigeria based on customer's perception. On the basis of the specific objectives of the study, the following questions are posed:

a. What are the factors affecting quality of service?

b. To what extent do all the factors collectively affect quality of service?

c. To what extent does each factor influence quality of service?

2.0 Conceptual Framework

The literature is filled with proliferation of different definitions for quality of service from different perspectives. It is defined as the extent to which a service meets customer's needs or expectations (Asubonteng et al, 1996). Parasuraman et al (1988), defined Quality of service as a form of attitude, which could be related to satisfaction that results from a comparison of expectations with perceptions of performance. The European Telecommunication Standards Institute (ETSI) definition of Quality of Service in the context of wireless networks states that it is the collective effect of service performances which determine the degree of satisfaction of a user of the service (Ian Hung et al, 2004). The concept of quality of service from the customer perspective, therefore, includes not only what (outcome) the consumer expects, but also how the consumer is served (Grönroos. C, 2001).
Quality of service is not just a corporate offering, but a competitive weapon which is necessary for corporate profitability and survival (Grönroos. C, 1990; Rosen et al, 2003). Thus, quality of service is a critical business requirement that is driven by customer's satisfaction, which in turn drives customer's

loyalty, retention (that eventually leads to profitability) and growth, as proposed in the Service-Profit Chain (Heskett et al, 1994).

2.1 Conceptual Model

Theories relevant to this research work is the Customer's Satisfaction Model. Base on customer's satisfaction, there are many variables and factors determinants of the Quality of Service of cellular mobile service providers as shown in the diagram below-
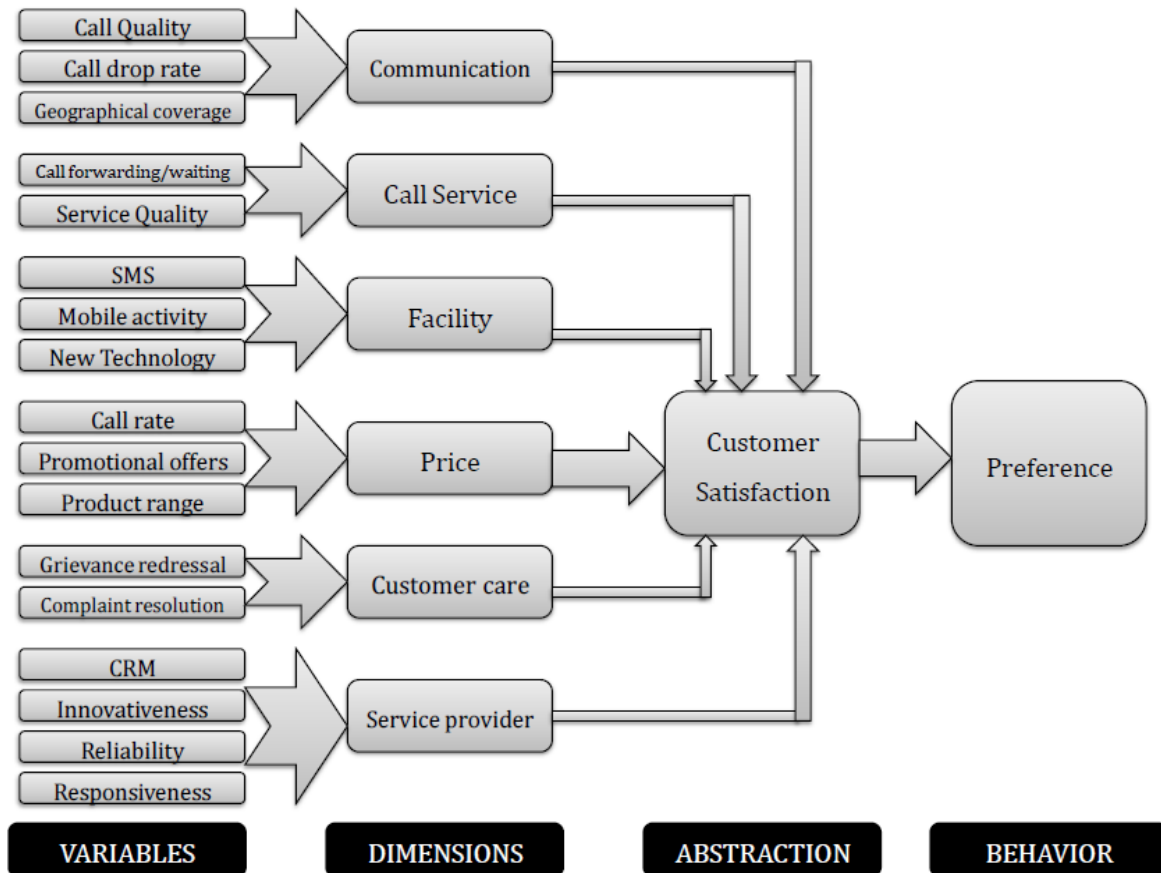

Figure 2.1 Customer's Satisfaction Model. Source: (International Journal of Innovative Research and Studies, 2013).

Haque et al (2010) benchmark mobile services with these attributes and dimensions. Communication is a function of Call Quality(i.e. clarity of call), Call Drop Rate and geographical coverage area of the network. Within each cell of the mobile network, there are mainly two classes of call traffic: new call and handover call. A new call is the one which is generated in the current cell, while a handover call is the one that is generated in another cell but transferred (handed over) into the current cell (Panoutsopoulos and Kotsopoulos, 2002). In order to establish a communication with a base station, a mobile terminal must first obtain a channel from the base station.

 A channel consists of a pair of frequencies: one frequency (the forward link/downlink) for transmission from the base station to the mobile terminal, and another frequency (the reverse link/uplink) for the transmission in the reverse direction. When a call enters into the radio coverage of current cell, the

channel allocation scheme decides whether the attempt of this call can obtain an available channel or not. If not, the call is dropped immediately. The handover process is often initiated either by crossing a cell boundary or by a deteriorated quality of received signal on the currently employed channel. Calls are drop when attempt for call handover fail. If two cells using the same channel or same set of channels are not effectively spaced apart, co-channel interference could result and this affect the clarity of call.

Another variable identified in the model is network coverage/Availability of service. Cellular network subscribers are increasingly becoming mobile and as such would prefer mobility in terms of product and services. When the geographical coverage area of a given cellular mobile network provider is small, some of the customers who travelled outside the coverage region will be denied service, this affect the degree of customers satisfaction. According to Quelch et al (2008), the customer's evaluation of quality is related to the availability of the salient futures of product/service in comparison with the competitor.

Price of Service in this case deals mostly with the call rate and the cost of other associated services charge by the network service providers. The special significance of price for the decision to purchase is as indisputable in the telecommunication sector as it is elsewhere. This is particularly true in the mobile telecommunication sectors as available studies suggest Rahman et al (2010). Also a study carried out by Hanif et al (2010), in Pakistan, revealed that there is a high correlation between price fairness, Quality of service and customer satisfaction

Promotion/Offering of incentive as a variable of the mobile service has to do with advertising campaign aimed at making products/services of the cellular mobile network operator widely known and acceptable by the subscribers. Also, the offering of material inducement in order to encourage subscribers to purchase the particular product/service of interest.

Onah (1978) defined market segmentation (Diversity of bundle option of service or Product range) as the process of dividing a market into units and locating individuals who belong to each market. He further stated that the assumption is to have people who are apparently homogeneous or have common characteristics grouped together. When market segmentation is based on the principle of consumption type, subscribers are given the option to select from the available range of service/Product, the service plan which best meet their expectation at any particular time.

Customer care is among the core attribute of mobile service. It deals with the ability of the cellular mobile network operators to handle satisfactorily and timely customer's complaint; Keeping customers informed as to when services will be performed and readiness to respond to customer's requests. Good customer care enhance loyalty Haque and Rahman (2010).

2.2 Contribution of Related Works and Research Gap

Factors affecting quality of service of cellular mobile network has been evaluated in numerous studies. Kostanic et al (2009) presented a QoS assessment methodology for cellular communication networks based on the data collected through drive-testing. The work focuses on the end user perception of service quality by providing independent QoS measurement for voice and data services. In their work, the authors discuss QoS assessment for both the circuit switched and packet switched side of the network; however, they fail to provide QoS measurements as function of both voice and data services simultaneously.

Weissberger et al (2009), stressed the importance of network operators evaluating user-perceived QoS of data services in cellular networks. In their work, the authors specify user's experience as a key factor in determining the network operator's success; and present a methodology for evaluating quality of the FTP data service in cellular UMTS networks. Their methodology is based on data collected through drive testing and can be easily extended to other cellular data services. However, the proposed methodology concentrates on evaluating end-user experience based only on data services on a single network.

Power (2009) studied the Quality of service of mobile cellular user in the United Kingdom. The study used a sample of 3,325 mobile phone customers throughout United Kingdom. The study showed that the Quality of service in the Telecommunication Industry is a function of how the service meets customer's expectation such as coverage, call quality, promotions, offerings of incentives and rewards, prices of service, billing and customers bundled services. Also, In Canada, the consumers' satisfaction survey in 2007 based on the responses of 6,000 mobile phone users indicated the essential elements of service quality of mobile operators as quality of calls, prices, billing, customers' services, and diversity of bundled options of services (Customer Satisfaction, 2007). The survey of 22,052 users of wireless phone in the United States in 2008 according to the Wireless Phone Users' Satisfaction Index of United States of America indicated that important dimensions of service quality include billing, brand image, call quality, cost of service and options for service plans (Customer Satisfaction Index, 2009)

A study carried out by Shoewu and Edeko (2011) revealed that the focus in Nigeria cellular mobile network has gradually shifted from providing coverage to providing diverse bundled options of services to customers since very limited service option could lead to dissatisfaction among subscribers and thus, reduce the perceived quality of service.

Yadav et al (2013) examine Quality of service and Customers Preference of Cellular Mobile Service Providers. The study shows that call quality and price were most influential and most preferential factors in selecting telecommunication service provider. However, product quality and availability has a significant impact on consumer perception (quality of service) choice in selecting cellular mobile service provider.

From the reviewed literature, it is evident that there is room for the development of a holistic and user-centric evaluation approach that provides objective measurements of Quality of service of cellular mobile network operators. This will allow network providers to better assess how well their services are being perceived relative to their competitors. This current work is geared towards providing a solution to these challenges.

3.0   Research Methodology

The primary source of data used in this research work was questionnaire while the secondary source of data include data from several ICT related sites like the Nigerian Communications Commission (NCC), International Telecommunication Union (ITU), MTN-Nigeria, Globacom, Etisalat, Airtel as well as data from the researchers in related topical issues. The questionnaire consisted of 3 sections: Section A is for the subscribers only, Section B is for the experts (employee of the four major telecommunication companies mentioned above) while Section C is for both categories. Section A and Section B elicited respondents' demographic characteristics such as age, gender, educational qualification, occupation etc. Section C contain questions asked to determine the subscriber's as well as the expert's view of the factors affecting quality of service of cellular mobile operators in Nigeria. In all, 400 questionnaires were

distributed to the subscribers but 293(73.3%) copies were retrieved and used for the analysis. Also,100 copies were given to the experts. The variables used to measure the influencing factors (Network Coverage and Availability of Service, Call Quality and Call Drop Rate, Price of Service, Customer Care, Diversity of Bundle Option of Service and Promotion/Offering of Incentive) using the 5-point Likert scale were coded as: Strongly Disagree(SD)-1, Disagree(D)-2, Neither Agree nor Disagree(N)-3, Agree(A)-4 and Strongly Agree(SA)-5. Data collected were subjected to multiple regression analysis using the SPSS (Statistical package for Social Sciences) software. The model describing the relationship is expressed as

$$Y= b_o + b_1X_1 + b_2X_2+ b_3X_3+ b_4X_4+ b_5X_5+ b_5X_5+ b_6X_6+e$$

Where X_1 = Diversity of Bundle Option of Service

X_2 = Customer Care

X_3 = Call Quality and Call Dropping Rate

X_4 = Price of Service

 X_5 =Network Coverage and Availability of Service

X_6 = Promotion/Offering of Incentive.

4.0 Model Estimation and Result Discussion

4.1 Relationship Model Estimation and Interpretation

In estimating the model, the data collected were subjected to multiple regression
analysis. The result obtained from the multiple regression analysis is as follows: R=0.456, R^2=0.208, adjustedR^2 =0.192, Standard error of the Estimate, = 3.64050, F = 12.531 and Sig=0.000. Using the regression output on the Tables 4.1-4.3, we estimated the following equation (4.1)-the relationship model:
$$Y = 3.731+0.565X_5 + 0.440X_3 + 0.221X_2+ 0.189X_4 + 0.165X_1 + 0.097X_6….(4.1)$$

Table 4.1: Coefficients of Correlation and Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.456[a]	.208	.192	3.64050

Source: FIELD WORK

Table 4.2: ANOVA of Sample Data

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	996.432	6	166.072	12.531	.000^a
	Residual	3790.435	286	13.253		
	Total	4786.867	292			

Source: FIELD WORK

Table 4.3: Model Coefficient Matrix

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	3.731	2.689		1.388	.166		
X_1	.165	.116	.078	1.419	.157	.910	1.098
X_2	.221	.150	.082	.1469	.143	.899	1.113
X_3	.440	.11	.206	3.753	.000	.920	1.088
X_4	.189	.106	.102	1.788	.075	.854	1.171
X_5	.565	.122	.263	4.636	.000	.861	1.161
X_6	.097	.086	.059	1.120	.264	.991	1.009

a. *Predictors: Network Coverage and Availability of Service(X_5), Call Quality and Call Drop Rate(X_3), Price of Service(X_4), Customer Care(X_2), Market Segmentation(X_1) and Promotion/Offering of incentive(X_6).*
b. *Dependent variable : Quality of Service of cellular mobile network operators in Nigeria.*

Source: FIELD WORK

4.3 Result Discussion

Results are discussed here in the context of the research questions.

Question One

What are the factors affecting quality of service of cellular mobile network operators in Nigeria?

From the literature review as well as the results of test carried out, several factors were discovered to affect the Quality of Service of cellular mobile network operators in Nigeria. The factors identified in this research were as follows: Network Coverage and Availability of Service, Call Quality and Call Drop Rate, Price of Service, Customer Care, Diversity of Bundle Option of Service and Promotion/offering of incentive.

The results obtained support the works of Power (2009) who found out that Quality of service in the Telecommunication Industry is a function of how the service meets customer's expectation such as, Coverage, Call quality, Promotions, Offerings of incentives and rewards, prices of service and customers bundled services. Also, it partly agree with the result obtained by the Wireless Phone Users' Satisfaction Index of United States of America which indicated that important dimensions of service quality include billing, brand image, call quality, cost of service and options for service plans (Customer Satisfaction Index, 2009). However, in Nigerian case there is a slight difference, the study showed that brand image have no impact on the quality of service of cellular mobile network providers.

Question Two

To what extent do all the factors collectively affect quality of service?

The test of hypothesis on this research question showed that collectively all the factors affect the quality of service of cellular mobile network providers. The conclusion was drawn from the F-test in which value of 12.531 is significant at 0.000, implying that testing at 0.05 level of significance, the P value of .000 is less than .05. This implies in reality that the six factors of quality of service adopted as a whole have a significant impact on the quality of service of cellular mobile network. It also confirm the result obtained by the consumers' satisfaction survey in Canada (2007) based on the responses of 6000 mobile phone users which shows that the essential elements of the Quality of Service of cellular mobile operators are: quality of calls, prices, billing, customers' services, and diversity of bundled options of services (Customer Satisfaction, 2007)

Question Three

To what extent does each factor influence quality of service?

The test of hypothesis on this research question showed that Network Coverage and Availability of service has significant impact on quality of service of cellular mobile network operators in Nigeria. The conclusion was drawn from the statistic t-test in which value of 4.636 is slightly significant at 0.000 level of significance, implying that testing at 0.05 level of significance, the P value of .000 is less than .05. This implies in reality that Network Coverage and Availability of service has significantly affected the quality of service of cellular mobile network operators in Nigeria.

It also revealed that Call Quality and Call Drop Rate has significant impact on quality of service of cellular mobile network operators in Nigeria. The conclusion was drawn from the statistic t-test (Table 4.12) in which value of 3.753 is slightly significant at 0.000 level of significance, implying that testing at 0.05 level of significance, the P value of .000 is less than .05. This implies in reality that Call Quality and Call Drop Rate has significantly affected the quality of service of cellular mobile network operators in Nigeria.

On the other hand, Price of Service has no significant impact on quality of service of cellular mobile network operators in Nigeria when considered separately. The conclusion was deduced from the statistic t-test (Table 4.3) in which value of 1.788 is not significant at 0.075 level of significance, implying that testing at 0.05 level of significance, the P value of 0.075 is greater than .05. This implies in reality that

Price of Service has not significantly affected the quality of service of cellular mobile network operators in Nigeria.

Again, Diversity of Bundle Option of Service, has no significant effect on quality of service of cellular mobile network operators in Nigeria when considered alone. The conclusion was obtained from the statistic t-test (Table 4.3) in which value of 1.419 is not significant at 0.157 level of significance, implying that testing at 0.05 level of significance, the P value of 0.157 is greater than .05. This implies in reality that Diversity of Bundle Option of Service has not significantly affected the quality of service of cellular mobile network operators in Nigeria.

Furthermore, Promotion/Offering of incentive has no significant impact on quality of service of cellular mobile network operators in Nigeria. The conclusion was drawn from the statistic t-test (Table 4.3) in which value of 1.120 is not significant at 0.264 level of significance, implying that testing at 0.05 level of significance, the P value of 0.264 is greater than .05. This implies in reality that Promotion/Offering of incentive has not significantly affected the quality of service of cellular mobile network operators in Nigeria when the factors are considered individually.

Finally, Customer Care as a quality of service factor has no significant impact on quality of service of cellular mobile network operators in Nigeria when the factors are considered individually. The conclusion was arrived at from the statistic t-test (Table 4.3) in which value of 0.1469 is not significant at 0.143 level of significance, implying that testing at 0.05 level of significance, the P value of 0.143 is greater than .05. This implies in reality that Customer Care has not significantly affected the quality of service of cellular mobile network operators in Nigeria.

 It is obvious from the result of this research that Network Coverage and Availability of Service, Call Quality and Call Drop Rate were the only significant factors that affect the Quality of Service of cellular mobile operators in Nigeria while other factors (that is Price of Service, Customer Care, Diversity of Bundle Option of Service and Promotion/Offering of incentive) were observed to be insignificant when considering their individual effect on the quality of service.

5.0 Conclusion and Recommendations
5.1 Summary of Findings and Conclusion

Based on the results of the analysis, the following findings were made:

a. That the most critical factor of Quality of Service in Nigeria are Network Coverage and Availability of Service, Call Quality and Call Drop Rate.

b. That collectively, all the identified factors (Network Coverage and Availability of Service, Call Quality and Call Drop Rate, Customer Care, Price of service, Diversity of Bundle Option of Service and Promotion/Offering of Incentive) affect the Quality of Service but when considered individually, only two factors (Network Coverage and Availability of Service, Call Quality and Call Drop Rate) have significant effect on the Quality of Service of cellular mobile network operators in Nigeria.

c. That Diversity of Bundle Option of Service and Promotion/offering of incentive as quality of service factors have the least impact on the quality of service of cellular mobile network operators in Nigeria.

Based on the findings so far made on this paper, the following conclusions have been made:

a. That Call Quality and Network Coverage/Availability of Product are the two factors that have the greatest impact on the quality of service of cellular mobile network operators in Nigeria.

b. That despite the huge amount of money spend on advertisement and promotional activities by the mobile communication companies, cell phone users in Nigeria are more price- sensitive than promotion-sensitive when judging the quality of service of cellular mobile network service provider.

c. That the poor quality of service experience in both urban and rural areas in Nigeria is associated with inadequate deployment of telecommunication infrastructure and overloading of the existing ones.

5.2 Recommendations

On the basis of the findings of this paper, the importance of quality of service in customer's satisfaction and retention cannot be overemphasize. For its enhancement the following recommendations were made:

a. Telecommunication industries should invest more on radio infrastructural development to ensure wide coverage area and also reduce call dropping rate associated with overloading the existing network facility to its capacity.

b. Proper maintenance of existing infrastructures is another major issue that needs to be addressed by telecommunication companies. Infrastructures should be properly maintained and alternatives should be put in place to sustain service in case of equipment failure.

c. The network operators should reduce their expenditure on promotional activities while concentrating on price reduction strategies as a way of enhancing service quality and increasing subscriber's base.

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