Selection of mobile network operator using Analytical Hierarchy Process (AHP) in Numan Local Government, Adamawa State, Nigeria

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ABSTRACT

The world is fast becoming a global village; and a necessary tool for this process is communication, of which telecommunication is a key player. The quantum development is very rapid, as one innovation replaces another in a matter of weeks. Interconnected phone calls across the different Nigerian telecommunication service providers are mostly difficult to connect and often diverted, incurring unnecessary charges on the customers. This compels the consumers to register and use multiple subscriber information modules (SIM) so that they can switch to another if one fails. This study aims to identify and prioritize the key factors in selecting telecom service providers by subscribers in Nigeria using the Analytical Hierarchy Process (AHP) in order to match the factors with the GSM network providers and create a hierarchical structure. Opinion of 400 random subscribers of different service providers were sought using questionnaire out of which 373 were retuned and considered valid. In general, four components and ten sub-components were examined in this study. After determining the weights of these components, the importance of each was prioritized and base on these criteria MTN was favored then Airtel and GLO and 9Mobile, second, third and fourth respectively.

Keywords: *Analytical hierarchy process, global village, telecommunication, subscribers.*

1 INTRODUCTION

Mobile phones have become a fundamental communication tool in both developed and developing countries. Previous studies have identified a number of reasons for owning or using a mobile phone as well as choice of phone operator (Hamel and Prahalad, 1991;Kumar, 1997; Nagel, 2003; Gerstheimer and Lupp, 2004; Chakraborty, 2005; Donner, 2007; de Silva and Zainudeen, 2007). Apart from expanded mobile phone usage, there has also been an increase in the number of network providers. According to Hansen (2003), the mobile handset market has experience between five percent and ten percent growth and a substantial growth in operator subscribers.

Nigeria is not left out, sixteen years into the introduction of global system for mobile communication; GSM had an increasing need for mobile phone services by an average Nigeria. Unlike when it was introduced in 2001, the service providers mostly provide services for calling/receiving calls, sending/receiving messages as most of the phones were not then produced with many applications. But now phones are becoming more complex by the minute as many applications are installed to render many services such as mobile banking,

internet connections, social media services and many more by mobile service operators. SIMs now go almost free to subscribers/customers as there is no disparity in the price it is sold for high, medium or low profile citizen as it was done when it was first lunched in 2001. Charges on services were high; less coverage and few service operators are some of the constraints at the early stage, but now, things have changed as a result of competitions by the service providers. Consumers/customers are at liberty to choose any of the networks of their choice to ease the problems of network failure, less coverage and high charges as well as quality of calls. At present there are four leading telecommunication operators in Nigeria, these are MTN, GLO, Airtel, and 9mobile.Since introduction, the sector plays a vital role in the economy of Nigeria. Especially in the last few years, the sector contributes to the economy through telecom service, collaboration in online banking remittance, education and welfare service as well as payments of bills. Besides these, this sector is now one of the major tax players in Nigeria. Like other service sectors consumer satisfaction and loyalty are essential for telecom operators. However, the services provided by the telecom operators nowadays are more or less the same. So it is quite difficult to assess the consumer's satisfaction on a particular operator. All the telecom operators are highly concentrated on the consumer satisfaction in providing services as a result; they are all coming with different packages for their consumers/customers. Therefore working on the assessment of consumer satisfaction in this industry is quite challenging. Subscribers who have an increasing needs for the use of mobile telecom attributes, are faced with great deal of complexity not only in deciding which of the network provider should they settle with when the market has implemented mobile number portability (MNP). Which accorded subscribers opportunity in retaining their known number rather than combining multiple SIMs, but which of the network providers is best suited to meet their needs For any service provider to survive in the current turbulent business environment, the needs and wants of the consumers/customers must be identified and anticipating for changes of their demands and satisfying there profitability. Though, many studies were conducted in this regard as can be seen in the literature cited. This article is aimed at validating or refuting some the findings of others researchers using the analytic hierarchy process (AHP) which is a theory of measurement for dealing with quantifiable and/ intangible criteria that has found rich application in decision theory, conflict resolution and in models of brain. It is based on the principles that, to make decisions, experience and knowledge of people is at least as valuable as the data they use.

2. OBJECTIVE OF THE STUDY

The objective of the study is to rank GSM operators using AHP model base on customers/consumers' preference.

The specific objectives are as follows;

a Ranking of factors affecting customers/ consumers preference

b Ranking of GSM operators under different criteria of customers/consumers preference

3. SCOPE OF THE STUDY

In line with the objectives of this article, the criteria, sub-criteria and the alternatives of some previous researches were used for this research. The criteria are networks while the sub-criteria are call charges, internet connection, bill pay, free talk-times and SMS, money transfer, balance recharge, customer care, brand image, voice clarity and the alternatives are MTN, GLO, Airtel, and 9mobile.The study was conducted in Numan, and the result is based on the data collected from the consumers/customers of these mobile networks.

4. LITERATURE REVIEW

Over the years, many researchers developed interest on this topic globally from Nigeria to Kenya to Indonesia to Malaysia to Pakistan to America and so on. The findings of those studies are more or less consistent in determining the criteria affecting the choice of service providers. In the area of business especially, in the telecom business no one can run efficiently without maintaining competitive advantage over the competitors. To gain competitive advantage, a business firm needs to provide better services quality than the competitors that led to the intense competition among the service providers. As far as customers are concerned, they benefit from this intense competition, in terms of low tariff, good service quality and frequent introduction of plan as per their requirements. But the dark side is that customers are in a dilemma over their choice of mobile service providers. They search and gather information on these factors, evaluate these factors to choose their subscription. In this context, it is of growing concern to look at customers buying decision process that cast light on the factors that finally determine consumer choice towards different service providers. Service quality is marked as highly significant concept of services management and service marketing. Researchers have proven that "Perception of service quality had a direct relationship with customer retention" (Clottey, Collier and Stodrick, 2008)

Different service quality factors of telecom operators are essential and important to maintain loyal and profitable customers (Leisen and Vans, 2001). Besides service quality factors branding and brand perception of the customers regarding the telecom operators affects the customer's preference for selecting telecom operators Landum, and Prybutok,. (2004).

According to Anckar and D'Incau (2002),beside voice call and network coverage the value added services (i.e, games, icons, ringtones, messages, web-browsing, SMS coupons, electronics transaction) provided by telecom operators brought five values to the consumers which includes- time- critical needs and arrangement, spontaneous needs thus, mobile value-added service will become new opportunities for telecom service providers. Previous studies of relevant field also provides evidences that the enhancement of service quality, perceived value, and customer satisfaction is the key to of cooperate success and competitive advantage (Patterson and Spreng,1997; Khatibi et al,. 2002; Landrum and Prybutok, 2004; Wang et al,. 2004; Yang and Peterson, 2004).

Rahman, S., Haque, A. and Ahmad, M.I.S. (2011) mentioned some variables as important criteria for customers' perception in selecting mobile phone operators. These variables are service quality, price or call rate and brand image. Shah (2008) mentioned customer care service, per call charges, network, tariff

schemes, value added service (VAS), billing system, voice clarity as some of important variables that customer consider while developing their preference about any mobile phone operators.

Singh, Vyas, . and Rathi, (2011) mentioned quality of service; price and effectiveness of advertising and marketing campaign are the important variables that affect the customer's preference for selecting telecom operators.

In their study Kim, Park, and Jeong, (2004) mentioned call quality, value added service and customer support are the important criteria for customer preference for selecting telecom operators. This study further categorizes service quality factors into four dimensions, including content quality, navigation and visual design, management and customer service, and system reliability and connection quality.

Chae, Kim, Kim, and Ryu, (2002) mentioned connection quality, content quality, interaction quality, and contextual quality, as some of important variables that affect the customers' preferences for selecting telecom operators. Tama and Tummalab (2001) mentioned some criteria as vendor specific criteria for selecting mobile phone operators, these are quality of support services, supplier's problems solving capability, supplier' expertise, cost of support services, delivery lead time, vendors experience in related products and reputation.

Howard and Sheth in (Loudon and Dellabitta, 2002)analyzed the buyer's decision marking by Howard and Sheth model taking six factor (psychological influencer – input – inhabiting factors – social and culture influence – processing determinants – outputs). Which play a vital role in consumer decision making.

A study conducted by kim et al. (2004) for Korean mobile communication service, revealed that the customer satisfaction towards MSP is strongly supported by call quality, value - added service operator.

Sandhir (2004) conducted a research in Ludhiana and identify that customers make their choice of an MSP by considering five factors: connectivity, coverage, tariff, VAS and customer care. It shows that industry cannot neglect these factors.

Neeraj and Girish (2007) have deducted those factors that consumers perceived to identified four factors – customer care services, call rates, promotion and availabilities, which are the most important factors considered by customers before utilizing the services of an MSP.

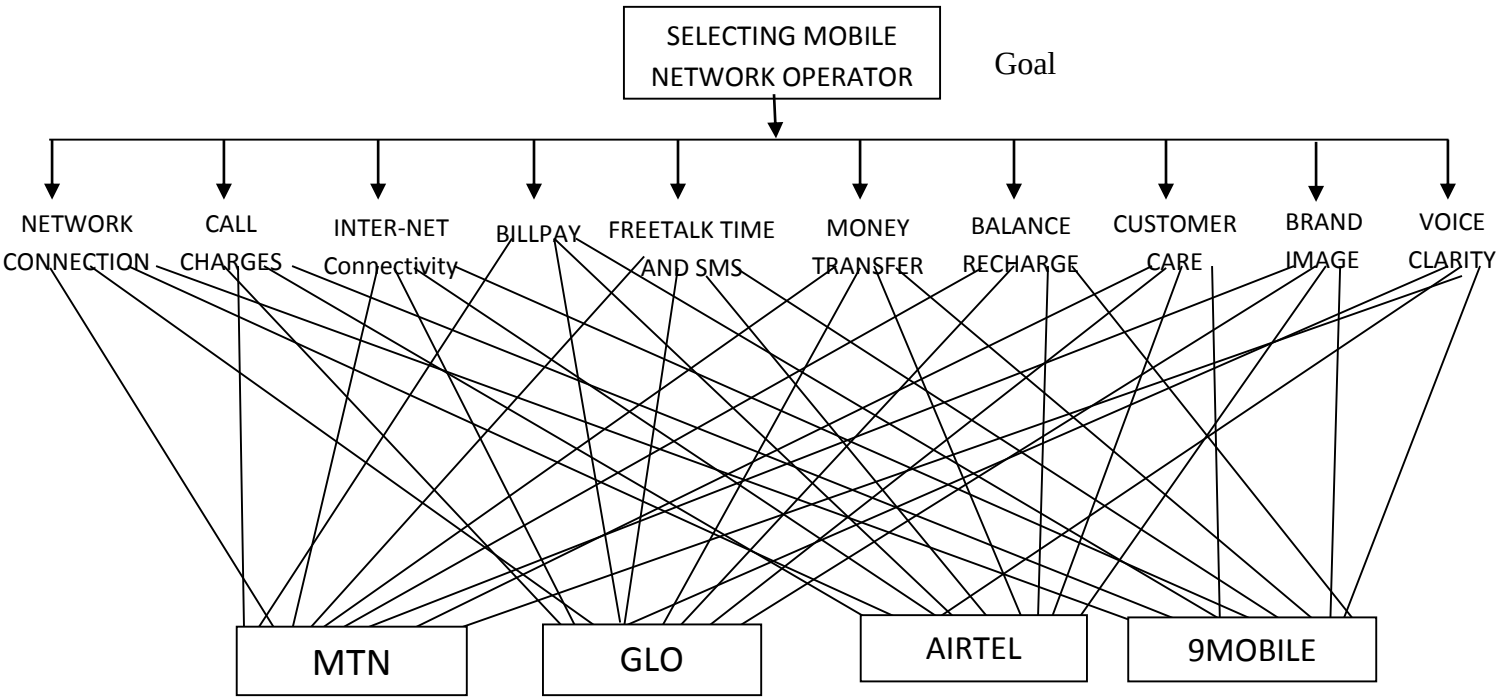
In order to know about customers' choice of MSP, Mohammed (2009) revealed that Makkah, Saudi Arabia, financial factors is most important in the selected of an MSP. Moreover, he added that there is no strong tendency among the customers to subscribe to the same service provider among family members and friends.

Kajalnoto et al. (2010) identified that customers' choice in the context of mobile phone finland have been influenced by seven factors, namely – innovation service, multimedia, design, brand, and Basic properties, outside influence, price and reliability, of these studies mainly explore the various factors that the customers consider before making their choice

From the previous studies one can draw a conclusion in a form of taking criteria from these related studies

5. THE ANALYTIC HIRARCHY PROCESS MODEL

AHP includes three phases, which are decomposition, comparative and priority synthesis (Saaty, 1980). The AHP model for this study is given in the diagram below.



Decomposition phase:

In the decomposition phase, hierarchical structure such that the top level represents the overall objective and the lower level indicates the main criteria and alternatives.

Comparative judgment phase:

In the comparative judgment phase, a comparison matrix at each level is constructed based on the user's preference from the numerical rating of pair wise comparison. In this phase, the AHP questionnaire was assigned in accordance with analytic hierarchy structure. All criteria and alternatives were compared pair wise extracting numerical scale 1 (equally important) to a (very important) rating to obtain their relative importance to the problem.

If there are n decision criteria or decision alternatives, then there will be (0.5) n (n-1) pair wise comparison in square matrices. A pair wise comparison matrix c, for n decision criteria is in the form

$$C = \begin{bmatrix} 1 & a_{12} & a_{13}\ldots\ldots\ldots\ldots & A_{in} \end{bmatrix}$$

$^{1}/a_{12}$	1	$^{a}{}_{23}$……..	a_{2n}
$1/a_{13}$	$1/a_{23}$	1…….....	a_{3n}
1	1	1……	1
1	1	1……	1
$1/a_{in}$	$1/a_{2n}$	$1/a_{3n}$…….....	1

A pair wise comparition matrix for decision alternatives with respect to each of the criteria uses the same form as the matrix above.

Priority synthesis phase:

The priority synthesis phase calculates a composite weight for each alternative base on the preferences obtained from the comparisons matrix. In this study, the technique used for the priority or weight determination is the eigenvector method. The right principle eigenvectors are estimated corresponding to the maximal eigenvalue λmax of the pair wise comparison. The resulting composite weights produce a relative ranking of the alternatives with top rank indicate an optimal alternative.

Consistency checking:

In making paired wise comparison, if preferable to have a small consistency ration (CR). Saaty (1980) suggested repeating the pair wise comparisons until CR reaches 0.1 or lower. CR is the ratio consistency index (CI) to random (RI), which is given as

$$CR = CI / RI \text{ where } CI = \frac{\lambda \max - n}{n - 1}$$

With λ max being the maximal eigenvalue and the standard RI value are those calculated by Saaty (1977) as shown below:

Random indices

N	2	3	4	5	6	7	8	9	10	
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51	

6.0 Research methodology

The aim of this study is recognized and priotrize the most important mobile service providers criteria in telecom industry in Numan Local Government, Adamawa State, Nigeria. To this end ten criteria were selected from the literature and customers. Then the criteria were distributed to 400 customers/ customers of these mobile service providers of self completed questionnaires. From the questionnaires distributed only 373 were duly completed return and considered valid for the analysis. This represents 93% which is

considered extremely good in view of time, cost and certainty. Questionnaires were systematically distributed utilizing convenience/deliberate sampling from walk – in customers at Numan market and also students in Adamawa State Polytechnic Numan. Even though, the sampling methods adopted are convenience/deliberate sampling which contain some limitations in terms generalibility as compared to other probability sampling methods, it was logically assumed that the sample in this study represented the whole population of mobile telecommunication service users in Nigeria. There was enough similarities amongst the elements within population to conclude that few of the elements (the sample) was adequately represented the characteristics of the population (page and meyer, 2000). In order to priotrize and allocate weight to the criteria a combined descriptive study type and empirical analysis was carried out. For the analytical purpose ranking of the telecom operators were made using analytical hierarchy process (AHP) model the empirical analysis was made just to rank the telecom operators base o some criteria relating to the customers/consumers choice. Therefore this study is a descriptive research with some empirical evidences. Expert choice was used for data analysis.

6. Questionnaire development

For data collection and empirical analysis, a questionnaire has been developed using AHP 1 - 9 scale. For simplicity and ensuring reliability, data collection is being made on face-to-face interview with the respondents. The following AHP is used in the study:

Table 4: AHP 1-9 scale

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Compromises between the above

Model Development

AHP model uses three stages for the data hierarchy. First stage contains the research goals, second stage contains the criteria of ranking and third stage contains the alternative for empirical analysis ten criteria are being selected for looking four network operators. The stages of the AHP model are summarized below

Stage I: Goal	selecting mobile network operator
Stage II: Criteria	network connection Charges

	Internet connectivity
	Bill pay
	Free talk time And sms
	Money transfer
	Balance recharge
	Customer care
	Brand image
	Voice clarity
Stage III: alternative	MTN
	GLO
	AIRTEL
	9 Mobile

3.5 DATA ANALYSIS TOOLS AND TECHNIQUES

Analyzing data in AHP model requires four steps of calculation. They are:

Step 1: construct the hierarchy by stating the goal/objective and identify the criteria and alternatives.

Step 2: construct pair-wise comparison matrices for all the criteria and alternatives. The matrix is determined through a number of deferent career scoring experts in the relevant fields as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & & \dots & \dots \\ \dots & & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

Where $A = (a_{ij})$, $a_{ij} > 0$, and $a_{ji} = {}^{1}/a_{ij}$

Step 3: determined the weights of the criteria and local weights of the alternatives from the above matrices by using normalization procedure. The criteria and local weight of the alternatives are determined by the following equations:

Calculating the sum of data of each rows, $\varpi_i = \sum_{J=1}^{n} a_{ij}$, i = 1,2,…..n and normalizing the local weights,

$\omega i = \frac{\sum_{J=1}^{n}}{\sum_{k=1}^{n}\sum_{J=1}^{n} a_{kj}}$, i = 1,2,……n. the normalizing local weights vector is determined by

$W = [\omega_1, \omega_2, \dots\dots, \omega_n]$

Step 4: obtain the global weights of the alternatives by synthesizing the local weights,

$$\begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}$$

$$B \times V == \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ b_{n1} \quad b_{n2} & \dots & b_{nn} \end{bmatrix} \times \begin{bmatrix} \dots \\ \dots \\ v_n \end{bmatrix}$$

Matrix B represents the local weights of the alternatives and each column represents the local weight under each criterion. The V matrix represents transpose of the local weight of criteria. Global weight is determined by multiplying the matrices B and V

Finally, the data analysis is being made using Microsoft excel spreadsheet and data consistency is being tested using statistical package for social science (SPSS) software.

Results and discussion

Synthesis output with respect to goals. As per the procedure of AHP as the initial stage a pair comparison is made on the criteria of consumers/customers priorities

S/N	**Criteria**	**Weights**	**Ranking**
1.	Network connection	0.3214	1
2.	Call charges	0.1956	2
3.	Internet connection	0.0625	6
4.	Pay bill	0.0027	10
5.	Free talk time/sms	0.0727	5
6.	Money transfer	0.0036	8
7.	Balance recharge	0.1741	4
8.	Customer care	0.0032	9
9.	Brand image	0.0265	7
10.	Voice clearity	0.1384	3

From the table the customers/consumers weight the network connection as the most important criteria for their choice of mobile network service, followed by cal=-61 and 2S charge, voice clearity, balance recharge, free talk timed/SMS, internet connection, brand image, money transfer, customer care and lastly pay bill. It is discovered that, the last five criteria are normally used by most the respondents.

The next is the pair-wise comparison of the four mobile network service base on each of the above ten criteria. The table below gives the summary.

Criteria of customers/consumer's priority

GSM	Network connection	Call charges	Internet connectivity	Pay bill	Free talk time/SMS	Money transfer	Balance of recharge	Customers care	Brand Image	Voice clarity
MTN	0.3352	0.2741	0.2413	0.4113	0.2112	0.3821	0.2941	0.2312	0.3612	0.2672
Glo	0.2141	0.2632	0.2215	0.2151	0.1823	0.2331	0.2822	0.3141	0.2571	0.2512
Airtel	0.2486	0.2511	0.3112	0.1241	0.2944	0.1921	0.3114	0.1942	0.1831	0.1675
9 Mobile	0.2021	0.2116	0.2260	0.2495	0.3121	0.1927	0.1123	0.2605	0.1986	0.3141

The results show that respondents preferred MTN Intents of Network connections, call charge, pay bill, money transfer, and brand image. The respondents preferred Airtel in terms of internet connectivity and balance recharge. Voice clarity respondents preferred 9Mobile while customer care, respondents preferred Glo.

Finally, the ranking of the alternatives is being made base on their respective globe weight. The summary of ranking is given below:

Global weights of the alternative and find ranking.

GSM Operators	Weight	Ranking
MTN	0.2927	1
Glo	0.2405	3
Airtel	0.2536	2
9Mobile	0.2132	4

The above table shows that respondents preferred the MTN Network than other network operators with 29.3%. Followed by airtel with 25.2% closely followed by Glo with 24.4% and finally 9mobile with 21.3%.

CONCLUSION

From the results, it is clearly indicated that the three factors viz; network connection, call charge and voice clearity are significant. It is also discovered that many respondents don't apply other factors.

From the service providers, MTN, and AIRTEL are move preferable than the others. It is recommendable for service providers in an area like this to intensify another network connectivity, low call charges and voice clearity in order to boost their patronage.

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APPENDIX I

MTN	0.3352	0.2741	0.2413	0.4113	0.2112	0.3821	0.2941	0.2312	0.3612	0.2672
Glo	0.2141	0.2632	0.2215	0.2151	0.1823	0.2331	0.2822	0.3141	0.2571	0.2512
Airtel	0.2486	0.2511	0.3112	0.1241	0.2944	0.1921	0.3114	0.1942	0.1831	0.1675
9 Mobile	0.2021	0.2116	0.2260	0.2495	0.3121	0.1927	0.1123	0.2605	0.1986	0.3141

0.3214	=	0.2927
0.1956		0.2405
0.0625		0.2536
0.0027		0.2132
0.0722		
0.0036		
0.1741		
0.0032		
0.0265		

APPENDIX II

1. Which mobile Network are you currently using?

   (a) MTN (b) Glo (c) Etisalat (d) Airtel

2. Wchi type of service are you using?

   (a) prepaid (b) post paid

3. For how long have you been using a particular service provider?

   (a) Below 6 months (b) above 6 months and below 1 years

   (c) above one year to below 2 years (d) above 2 years

4. Have you ever switch from one service provider to another?

   (a) Yes (b) No

5. If yes, the change is from :

   (a) MTN to Glo (b) MTN to Etisalat (c) MTN to Airtel

   (d) Glo to MTN (e) Glo to etisalat (f) Glo to Airtel

   (g) etisalat to MTN (h) Etisalat to glo (i) Etisalat to Airtel

   (j) Airtel to MTN (k) Airtel to Glo (l) Airtel to etisalat

6. How important are the following criteria for choosing a mobile service provider (MPS): Rate these factors on a scale of 1-5 on the basis of your preference.

(1) Least important (2) Unimportant (3) Neutral (4) important

(5) most important

Criteria	**1**	**2**	**3**	**4**
1. Network connection				
2. Call charge				
3. Internet connection				
4. Bill pay				
5. Free talk time and SMS				
6. Money transfer				
7. Balance recharge				
8. Customer care				
9. Brand image				
10. Voice clarity				

6. There are several motivators who motivate you to choose (MSP).

   Select one from the list.

   (a) Recommended by family members, friends, and peers ( )

(b) Recommended by retailers ( )

(c) Same operator with family/relatives/chose friends ( )

(d) Corporate connection ( )

(e) I decided by my self ( )

7. Are satisfied with the service of your current service provider.

(a) Yes (b) No

8. If No, would you like to change your current service provider.

(a) Yes (b) No

9. If any means you want to change, which of the following would you prefer to opts.

(a) MTN (b) Glo (c) Etisalat (c) Airtel

10. Do you prefer having more than one service provider.

(a) Yes (b) No

11. If yes, which and which

(a) MTN and Glo (b) MTN and Etislalat (c) MTN and Airtel

(d) Glo and Etisalat (e) Glo and Airtel (d) Etisalate and Airtel

12. Does promotional calls and SMS by your service provider irritates you?

(a) Yes (b) No