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Measuring attractiveness by a categorical based evaluation technique (macbeth) for churn and retention of decision of subscribers in the Nigeria telecommunication industry

S. O. Adebiyi*, E. O. Kupolati, O. G. Oyenuga

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Abstract This study investigates the use of Multi-Criteria Decision Making (MCDM) method known as Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH) for evaluating the motivations for churn and retention decisions among subscribers in the Nigeria telecommunication industry. The study adopts quantitative and analytical methods with the aid of a questionnaire administered to one hundred and twenty-three subscribers of mobile telecommunication in the University of Lagos, Nigeria. Based on this sample data the MACBETH model was built with the aid of M-MACBETH to assess the determinants of customers' churn and retention decision among subscribers and to rank the telecommunication service providers based on service attributes. The results reveal that subscribers considered signal quality /strength as the most influencer criterion for churn and retention decision with higher ranks favouring retention and lower ranks in favours customer churn decision in the telecommunication industry. Thus, telecommunication firms should invest more in technology to boost and sustain high quality signal of their service in order to be thriven in the competitive market.

Keyword: Subscriber Churn, Retention, MACBETH, Telecommunication.

1 Introduction

Telecommunication has become the backbone of the contemporary society. It has made globalization a reality, bringing almost everyone under its network coverage. At least as at now, it has no better replacement in modern communication development. The significant increase in the benefit of telecommunication could be seen in the full execution of globalization, privatization, and liberalization.

Telecommunication has foster national development through modernization, industrialization, and automation. Telecommunication is one of the prime sustenance services needed for speedy development of any developing economy [1]. With the aid of internet and

* **Corresponding Author. (✉)**
E-mail: soadebiyi@unilag.edu.ng (S. O. Adebiyi)

S. O. Adebiyi
Department of Business Administration, University of Lagos, Nigeria.

E. O. Kupolati
Department of Business Administration, University of Lagos, Nigeria.

O. G. Oyenuga
Department of Business Administration, University of Lagos, Nigeria.

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telephony communication people has been able to enjoy the full benefit of e-governance, data could be shared and exchange ideas and information has given the possibility of the society to transform into an information society.

The situation in which information can be received at different sources, an information society can convert into a knowledge society. In knowledge society the citizens are aware of their roles in contributing their quotas in the overall development of a nation.

In Nigeria, the telecommunication industry has the largest share of the information and communication sector. The Nigeria telecom industry is one the largest market and fastest growing industry in Africa. The deregulation of Nigeria telecommunication industry has brought multinational mobile telecommunication firms into the market which was previously dominated by Nigeria Telecommunication Limited (NITEL).

The industry has experienced rapid expansion and contributed greatly to the Nigeria's economy and the lives of Nigerians. According to Nigeria telecommunication industry regulator, Nigerian Communication Commission (NCC) and validated by National Bureau of Statistics (NBC), the Nigeria telecommunication industry contributed approximately 10% to the Gross Domestic Product (GDP) of Nigeria economy in the second quarters of the year 2018, the subscribers and teledensity was approximated to 170,000,000 and 120% respectively, in which the leading telecommunication operators are MTN, Globacom, Airtel, and 9Mobile with 40%,26%,25%,and 9% market share respectively [2].

Other telecommunication operators in Nigeria are viz; nTEL, Visafone, Multilink, Zoom Starcomm, Smile, Spectranet, Main One, Swift Networks Limited.

Consequently, the increase in number of telecommunication operator in the industry has stirred the competition in the market. The condition makes mobile telecomm firms not only to increase their service quality, but also change their marketing core strategy from increment to retaining their existing subscribers by improving and enhancing the subscriber's retention. Each service operator competes to retain subscribers/customers, and do everything possible to avoid subscriber churn.

As mobile telecommunication becomes indispensable to business transaction, telecommunication industry like every other industry, customer's importance to business is paramount, and how to attract, develop and maintain customers/subscribers has become more important in the dynamic and sharp internationalized mobile telecommunication competitions. The issue of how to promote customer retention is very crucial to mobile communication operators.

Therefore, customer retention and churn are playing a significant role in the telecommunication market competition because it has become a critical variable in the fight for survival among mobile telecommunication service operators. The telecommunication industry is one of the firms that is most faced with the issue of customers' churn [3]. Also, according to research that was carried out in the telecommunication industry shows that the cost of getting a new customer is far beyond the cost of retaining the existing customer and the industry is one of the firms that was affected by churn rate and great churning loss [4].

In view of this, the telecommunication operators that can draw and retain subscribers in this highly competitive and progressively saturated market stand poised to make reasonable return as the competitors in the industry are shifting their tactics from a growth model to a value-added one.

Attracting new subscriber requires firms to invest quite much money and most times span a long duration associated with risks and uncertainties. The more subscribers that can be retained translate to increase in market share and in turn boost the revenue.

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Customer satisfaction in the area of quality service is to improve on customer retention and prevent customer churn, become the priority of the telecommunication service provider. Quality service in telecommunication industry can be in terms of call quality, charging rate, signal quality, bonus, and SMS delivery.

Hence, Subscribers always desire to select a particular operator considering certain criteria and at the same time having the intention of optimizing their choice. In a decision problem situation of many conflicting criteria in which for the decision makers each and every one of the criteria may have different levels of important than the other one and the aim is to determine the best alternative among the given alternatives from the worst to the best according to the criteria.

The nature of the problem stated show that Multi-Criteria Decision Making (MCDM) methods or Multiple-criteria decision analysis (MCDA) can be employed to evaluate the problem [5].

Measuring Attractiveness by a Categorical Based Evaluation TecHnique (MACBETH) is such an MCDA approach having the benefit of taking into consideration the decision makers' subjective judgments about different alternatives in relation to the evaluation criteria and translates those attributes into quantitative value [6].

This ability of MACBETH method confirms its applicability for solving telecom service operator selection problems. To the best knowledge of the researcher, although subscriber churn and retention in the telecom industry has been widely studied using various techniques such as data mining, survival analysis, Markov chain [3] logistic regression [7].

However, Multiple-criteria decision analysis (MCDA) such as MACBETH approach has not been extensively studied in customers' churn and retention in telecommunication industry. This is the major gap this study intends to fill with MACBETH. Therefore, this study is approaching to explore the application of Measuring Attractiveness by a Categorical Based Evaluation TecHnique (MACBETH) for the churn and retention decision of subscribers in the Nigeria telecommunication industry.

2 Literature review

MACBETH method has been used to take care of multi-criteria decision making problems. Vast numbers of these applications focus on evaluation and selection. Customers churn and retention has been widely studied using different techniques. Hence, this section examines how MACBETH approach is applied in literatures and how churns and retention was studied from different point of views, areas and fields.

Bana e Costa, and Chagas [8] in their work of building a numerical model of values from qualitative value judgment about the difference of attractiveness in the career choice problem, MACBETH approach was used to support individual decide his prospective career from various options. The career choice includes; banking, broker, corporate sales, high school teaching, consulting, and service sector, while the criteria include; working day, travel monetary reward, enjoyment, respect, personal, satisfaction, and location flexibilty. The outcomes was corroborated with that of SMART (direct numerical technique) when compared.

Ahn, Han, and Lee [9] in their work on churn analysis which centre on churn determinants and mediation effects of incomplete defection in the market of Korean mobile telecommunications service using billing data and customer transaction. The study outcomes show that call quality-related factors impact subscriber churn and heavy users have tendency

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to churn. Also, that some churn determinants impact on subscriber churn, either directly or indirectly via a consumer's status variation, or both; thus, a subscriber's status variation elucidates the connection between churn determinants and the possibility of churn.

Mavri and Ioannou [10] investigated the predicting and behaviour of customers churn in the banking market of Greek as related to customer relationship management (CRM). The study used the life tables and the proportional hazard model (PHM) in the analysis, the outcomes indicated that the quality of the obtainable banking products and services couple with the bank's brand name have a positive influence in the decrease of switching behaviour while demographical features, such as sex and scholastic level have a limited effect.

Oyatoye, Adebiyi, and Amole [11] investigated the subscribers preference for mobile telecom qualities in Nigeria. Mobile telecom was described in the conjoint study as having the five attributes that users evaluated in the survey: cost, customer service, call quality, coverage, and SMS delivery. In the five attributes that the consumers have more inclination toward, affordable service, wide coverage, followed by clarity of call, and being the most expected attributes by subscribers.

Karandea, and Chakrabortyb [12] demonstrated the applicability of MACBETH in solving multi-criteria decision-making (MCDM) task, that comprises of several conflicting evaluation criteria of supplier selection in a manufacturing environment. In the study, MACBETH was used as a decision support tool while resolving two actual supplier assortment tasks having qualitative performance measures. The capacity of MACBETH technique to enumerate the qualitative performance measures aids to provide a numerical judgment scale for ranking the alternative suppliers and selecting the greatest individual. The outcomes gotten from MACBETH technique precisely agree with those derived by the previous scholars employing various mathematical methods.

Karandea, and Chakrabortyb [6] demonstrated the applicability and usefulness of MACBETH in complex decision-making task that includes several conflicting evaluation criteria such as selecting the best facility layout design, as the performances of the options with respect to these criteria are usually stated in qualitative as well as numerical measures. The authors solved actual facility layout selection task, which consist of four alternatives (L1, *L*2, *L*3 and *L*4) against five criteria (Area available for each assembly group, Material quantity flow, Accessibility for fire fighting, Comfort of crew and Interaction with existing facility distance). The outcomes gotten from MACBETH approach using the MACBETH software (M-MACBETH) precisely agree with those derived by the previous scholars.

Pratama and Dachyar [13] evaluated the performance of a drilling task in oil and gas service firm in Indonesia using MACBETH approach.The authors model the project elements into a supervisory level group in order to expedite decision making by the project supervisor These measurements will yield levels of supervision classification of project element groups, i.e., strong attention, close surveillance, absolute vigilance, and normal monitoring of the project elements. This study discovers that the criteria of time, cost, effectiveness, efficiency, and complete reports & field tickets require absolute vigilance so that the performance criteria can be improved.

Dahiya and Bhatia [4] in their research on customer churn analysis in telecommunicationn industry in India implemented with weka mining software, compared effieciency of diffferent churn predicting models,that the ability of service provider to predict likelihood of customer churning will go in a long way of strategysing best way of retaining such customer. Decision tree technique was found to be more efficient compare to logistics regression technique in identifying potential churner of a particular service provider.

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Oyatoye, Adebiyi, and Kuye [14] investigated customer retention decision at the instance of the advent of mobile number portability in the telecommunication industry in Nigeria using Analytic Hierarchy Process (AHP). The outcomes show that quality of calls is the most vital customer retention influence, followed by competitive rates, efficient internet plan, frequency of promotional activities, good complaint management, prompt message delivery, and broadly spread/known number. The authors opined that as a result of the comprehensiveness of the outcomes, it ought to serve as a yardstick against which the priorities of service providers should be aligned; peradventure they are out to increase customer retention.

Amin, Shehzad, Khan, Ali, and Anwar [15] in their work on churn forecast in telecom industry using rough set approach, four different algorithms which include; genetic, lem2 covering, and exhaustive, were used to explore their performance. It is experiential that rough set classification built on genetic algorithm, rules generation produces greatest suitable performance out of the four rules generation algorithms. Furthermore, the application of the technique on available dataset in the public domain, the outcomes reveal that the method can conveniently forecast all those subscribers that will churn or probably might churn and also offers useful information to decision makers at the same time.

Oyatoye, Adebiyi, and Mojekwu [3] examined the modeling and forecasting of subscriber churn and retention rate using Markov chains in Nigeria telecom industry, in the study which secondary data was used through a survey and Windows-based Quantitative System for Business (WinQSB) was used for the evaluation. The outcomes show that MTN has the topmost retention rate (86.11%), followed by Globacom (70.51%), Airtel (67%), and 9mobile (67.5%). The outcomes further revealed the subscribers' movement among the operators in the industry, thereby serves as aids in formulating strategies to survive in such competitive industry.

Oyeniyi and Adeyemo [16] presented a data mining model data can predict the customer that is most likely to switch banks. The analysis was carried out with WEKA (data mining software) using raw data from the records of customer transactions in a major Nigerian bank, which was first cleaned and pre-processed. Rule-based algorithm (JRip) was deployed for the rule generation stage, while simple K-Means was deployed for the clustering stage. The outcomes obtained revealed that the methods deployed can predict patterns in customer behaviours and help banks to recognize possible churners and hence develop customer retention strategies.

Tosun [17] applied MACBETH in the evaluation and selection of technology in production environment to overcome the multi criteria decision making problem. In the study, there are four options (Alt 1 – Alt 2 – Alt 3 – Alt 4.) against six criteria (Purchasing cost, References, System compatibility, Flexibility, Technical support, and Capacity) which are quantitative and qualitative and at the same time subjective and objective in nature that are conflicting with each other. Decision makers opinion were weighed to rank (Alt 3 – Alt 2 – Alt 1 – Alt 4) the choices.

In view of the literature review above, studies have been done on customer churn and retention in many industries especially banking and telecommunication using different techniques such as neural network, data mining, decision tree, conjoint, regressions, AHP and Markov chain. However, Multiple-criteria decision making (MCDM) like MACBETH approach has not been widely studied in subscribers' churn and retention in telecom as far research is aware. This is the main gap this study intends to fill with the application of MACBETH to assess the significant alternative attraction to subscribers` decision to churn or remain with a telecom service provider.

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3 Methods

The research employed designed questionnaires structured to suite MACBETH based survey in collecting the primary data. The copies of questionnaires were designed in close ended questions format with response in order to identify preference level of motivators, and criteria in relation to the goal and the alternatives from the subscribers' views. According to Somocor [20], if real information is desired to be gotten, then a questionnaire should be employed. He added that a questionnaire has a distinctive benefit and when appropriately administered can serve as the most suitable and valuable data gathering devise for a study. Moreover, the questionnaire was partitioned into two sections: The first section was based on the demographic background of the respondents such as age, gender, and qualification. The section two consists of questions designed on the fundamental scale of the pairwise comparison format of MACBETH using the five criteria (Signal Quality, Call rate, Network Coverage, Promotion/Bonus, Customer Care) and four alternatives (AIRTEL, GLO, MTN, 9MOBILE) in accordance with a semantic scale below (see Table 1). For each criterion, the alternatives were pairwise compared against each other. Each criterion having 6 questions and aggregate of 30 questions for the five criteria was used in evaluating the motivators (criteria) in the churn and retention of telecommunication service provider among subscribers and ranking the alternatives.

MACBETH allows the assessment of choices against several criteria. The main difference between MACBETH and other (MCDA) methods is that it permits qualitative judgments about the variance of attraction between two elements at a time, in order to produce quantitative marks for the alternatives in each criterion and to weight the criteria. The seven MACBETH semantic categories are: extreme, very strong, strong, moderate, very weak, weak, and null difference of attractiveness. From the operator point of view, MACBETH has several resemblances with AHP. A beginner may even not understand the difference. Both approaches are created on pairwise comparisons entered by the user, but MACBETH uses an interval scale and AHP implements a ratio scale. The arithmetic process behind AHP is different from MACBETH [18].

According to Karandea and Chakrabortyb [12] the steps of the MACBETH method can be summarized as follows:

Step 1. Judgment criteria are well-defined and stated in the form of a value tree.

Step 2. Then choices and the ordinal performance levels of them with respect to each criterion are well-defined. Minimum two reference levels are needed to be known as upper reference (good) level and lower reference (neutral) level. The upper reference level indicates the mark of 100 while lower reference level indicates the mark of 0 on MACBETH scale. But 100 does not always show the best performance and also 0 does not indicate the poorest performance of an alternative [19].

Step 3. The alternatives are organized in an n x n matrix form from left to right according to their prominence to compute the qualitative performance levels or convert quantitative performance levels into equivalent MACBETH scale. Here n shows the number of alternatives designated for that criterion. Also, the similar process is realistic for the criteria.

Step 4. Pairwise comparisons are prepared for the criteria and alternatives based on difference of attractiveness. MACBETH technique uses a semantic scale fixed with seven categories to show the difference of attractiveness. The equivalent numerical scales and Significances of these semantic scal.es can be seen in Table 1.

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Table 1 Semantic scale of macbeth

SIGNIFICANCE	SEMANTIC SCALE	EQUIVALENT QUANTITIVE SCALE
Indifference between Alternatives	Null	0
An alternative is very weakly attractive above Another	Very weak	1
An alternative is weakly attractive above another	Weak	2
An alternative is moderately attractive above Another	Moderate	3
An alternative is strongly attractive above another	Strong	4
An alternative is extremely attractive above another	Very strong	5
An alternative is extremely attractive above another	Extreme	6

Source: Karandea and Chakrabortyb [12]

Step 5. The reliability of the decision makers' judgments is checkered. If the decisions are inconsistent, M-MACBETH software recommends probable alterations to make the decisions consistent [8]

Step 6. The consistent judgments are converted into a suitable numerical scale, known as the MACBETH scale built on linear programming models.

Step 7. Lastly, the weighted global scores representing the total attractiveness of the identified alternatives are calculated using an additive combination model to rank the alternative [20].

3.1 Model specification

MACBETH is a pairwise evaluation-based technique on an interval scale that constructs task in a tree or hierarchy. MACBETH is assisted by M-MACBETH software. M-MACBETH is a user-friendly package with in-built graphical user platform that automatically calculates attractiveness and probable inconsistencies.

In MACBETH, requires to complete three steps in order to obtain the rank of the alternatives. As with any MCDA technique, the first step is to construct the task in a tree or hierarchy as in Figure 1 below, followed by keying pairwise comparisons into a judgment matrix. If the matrix is satisfactorily consistent, the attractiveness can be evaluated, otherwise it is obliged to revise the decision. Finally, a voluntary sensitivity assessment can be processed.

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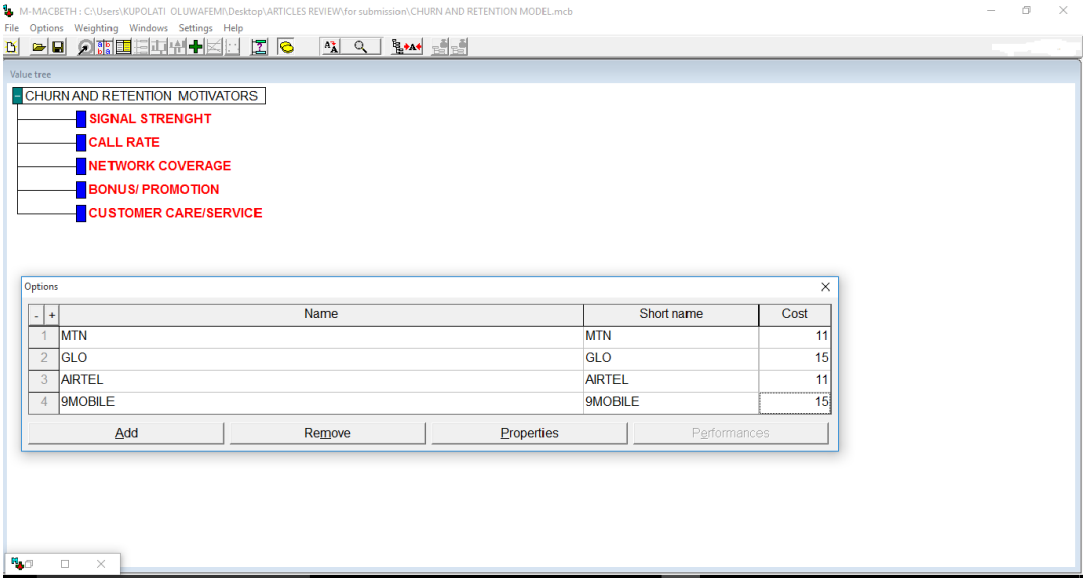

Fig. 1 The MACBETH Model for Churn and Retention in Telecom Industry
Source: Authors' own study from M_MACBETH

4 Data analysis and discussion of findings

Microsoft Excel and M-MACBETH was deployed into the study as analytical tools. The Microsoft Excel was used in computing the MACBETH designed based questionnaire. It was also used for combining the entire questionnaire data into a unified questionnaire data through arithmetic mean (zero number was involved and no extreme value). Whereas, the main analytical tool that is, the M-MACBETH was utilized in organizing decision makers' judgment to aid effective decisions making. This software also helps in checking consistency of individual respondent judgment on motivators of churn and retention of telecommunication service provider among subscribers and how they reflect on each service provider.

Table 2 Overall results and the ranking of the alternatives

Table of scores

Options	Overall	SS	CL	NC	BP	CC
MTN	87.92	100.00	85.71	91.67	42.86	91.67
GLO	52.99	40.00	71.43	41.67	71.43	41.67
AIRTEL	33.25	20.00	42.86	25.00	71.43	25.00
9MOBILE	13.51	0.00	14.29	8.33	71.43	8.33
[all upper]	100.00	100.00	100.00	100.00	100.00	100.00
[all lower]	0.00	0.00	0.00	0.00	0.00	0.00
Weights :		0.3500	0.3000	0.2000	0.1000	0.0500

Source: Authors' study from M_MACBETH

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Table 2 shows the MACBETH model in form of table of scores. The first column contains all the alternatives (MTN, GLO, AIRTEL, and 9MOBILE) of the study and the two reference points (all upper and all lower) of the M-MACBETH. The second column contains the overall aggregate weight for each corresponding alternative, that is; 87.92, 52.99, 33.25 and 13.51 for MTN, GLO, AIRTEL, and 9MOBILE respectively. The last five column contain the aggregate weight for each alternative from the determinants (criteria) of the study and the base of each criterion is the aggregate weight for the determinant, that is; signal strength (35) having the highest value, follow by call rate (30), then network coverage (20), bonus/promotion (10) and customer care (5) having the least.

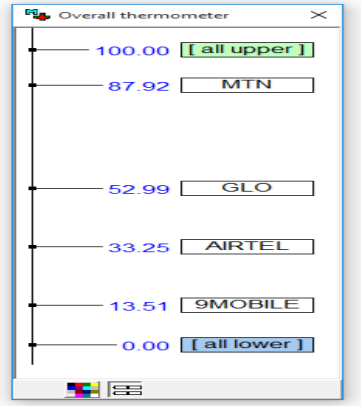

Fig.2 Overall thermometer
Source: Authors' study from M_MACBETH

Figure 2 corroborated the content of the second column (overall) of the Table 2 graphically. The graph is showing the overall level of each telecom service provider on weight according to the subscribers' opinions. That is; signal strength (35) having the highest value, follow by call rate (30), then network coverage (20), bonus/promotion (10) and customer care (5) is having the least.

The study employed MACBETH model in evaluating the determinants of subscribers churn and retention in telecom industry in Nigeria using University of Lagos. The determinants comprise of signal strength, call rate, network coverage, bonus/ promotion and customer care.

From MACBETH model in Table 2 and data analysis, finding depicts that telecom subscriber's derived highest service satisfaction from the telecom service providers through the signal quality with aggregate weight of 35%, followed by call rate of 30%, network coverage of 20%, then bonus/promotion of 10% and customer care of 5%. It has in turn influence the rate of churn and retention of the customers. This finding supported similar studies conducted by [14] on customer retention decision at the instance of the advent of mobile number portability (MNP) in the telecommunications industry in Nigeria using Analytic Hierarchy Process (AHP), the outcomes show that quality of calls is the utmost vital subscriber retention influence, followed by competitive rates, efficient internet plan, frequency of promotional activities, good complaint management, prompt message delivery, and broadly spread/known number. The signal strength/quality which influences most respondents' decision to churn or retain a telecom service provider has to do with making an efficient call, able to make a call successfully without interruption or call drop. The backbone of any quality signal is always a deployment of good and recent technology. The closest to

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signal quality is call rate, this depict that respondents are ready to pay for the service received in as much is of quality and satisfying.

Similarly, the MACBETH model in Table 2 and data analysis depicts the degree of attractiveness of each telecom service provider which in turn serves as the rate of retention. MTN has highest degree of attractiveness of 87.92%, followed by GLO of 52.99%, AIRTEL of 33.25% and 9MOBILE of 13.51%. In support of this finding was a study conducted on the modeling and predicting of customer churn and retention rate using Markov chains in Nigeria telecom industry, the outcomes show MTN has the topmost retention rate (86.11%), followed by Globacom (70.51%), Airtel (67%), and 9mobile (67.5%) [18]. The results revealed more on subscribers' movement among the telecom service operators in the industry, thereby serves as aids in formulating policies to continue in such competitive industry. The MTN which has the highest degree of attractiveness which was largely due to better signal quality [3].

Meanwhile, as telecom service providers are striving to increase their profit, it is to be noted that profitability of any business establishment has a relationship with the number of customer and the service rendering by the establishment. In view of this, it is expedient for every profit-making business venture should have a better way of increasing their customers and also managing the customers. In doing this, evaluating existing customers and predicting future customers is necessary as in this study that employed MACBETH method as was used in the works of other scholars [17, 13, 14], this is in line with the work of [4] on customer churn analysis in telecom and agreed with the research of [15] on churn forecasting in telecom industry. However, other industry such as banking are not left out of epidemic of customer churn buttressed in the study of [10] and [16] using data mining method.

Furthermore, based on the results of the study which revealed that telecom subscribers are more interested in quality service in term of signal strength/quality. It becomes imperative for any telecom service provider that wants to remain in the competitive market to improve on their quality of service. This can largely be achieved through the deployment of relevant and necessary state of the art technology with proper maintenance culture. Meanwhile, both in-house and outside continuous training of the personnel is germane to the continuous proper functioning of the deployed equipment.

5 Conclusion, Recommendations and Suggestion for future investigation

The study conveys the pertinent subscriber records and awareness for churn and retention using an almost unexploited operation research model MACBETH in analyzing data collected from subscribers in order to improved decision making and subscribers` management in telecommunication industry. In addition, as far researchers are aware, application of MACBETH for effective customer churn and retention decision in the telecom industry is very rare, thus, has contributed to the dearth knowledge in literature within Nigeria and in the other part of the world.

After thorough and systematic execution of this study, the following can be concluded:

i. The major influencer of any telecom subscriber is signal strength/quality, call rate/tariff, network coverage, bonus/promotion and customer care/service.
ii. The signal strength/quality is the most important determinant (criteria) for subscriber to be retained or churned and customer service is the least significant determinant.
iii. In the light of the determinants above, MTN, GLO, AIRTEL and 9MOBILE was ranked in the first, second, third and fourth place respectively.

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iv. It is also to be noted that the pairwise assessment of performance among the alternatives and selected reference levels aid produces accurate outcomes in MACBETH techniques. In addition, the provision of M-MACBETH software also increases the effectiveness of this method in resolving multifaceted decision-making task having performance of the choices stated in ordinal scale.

The following recommendations are proposed based on the findings of this research:

(i) The telecom service providers should reinforce quality service delivery by focusing on highly ranked churn and retention determinants such as signal strength and call rate in order to boost the market share.

(ii) Service providers should concentrate more on deployment of facilities to places which there is poor signal.

(iii) There is need for sustainable promotions, while concentrating on making the call rate affordable as a way of ensuring high degree of retention.

(iv) Mobile service should focus more on network extensions to various locations where there is no network coverage as a way of increasing subscribers' base and attractiveness.

(v) The regulatory bodies should give proper monitoring of the operators to ensure quality service delivery, in the light of the stakeholders' expectation.

(vi) The telecom service provider should consider the use of MACBETH to know the degree of attractiveness of subscribers to service attributes which is customer based rather than techniques such as data mining which is database driven.

This study and the outcomes therein help as a benchmark for prospective research(s) in this area as they assess the robustness of the model and sensitivity analysis of churn and retention criteria.

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