Technological Innovations, Service Quality and Customer Satisfaction in Cameroons' Mobile Telecommunication Industry

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Abstract: *The quantum leap in technology and its discernible spillover in telecommunication, flanked by wide markets; magnetise adept and belligerent players, who endeavour to dispense wide and innovative services to consumers. Today, there is no doubt that mobile telecommunication has lulled everyone into an excited stupor, that has radically transformed the social landscape of nations. Consequently, marketing in the 21st century has been witnessing an almost proportionate change in customers' preferences to the evolving technology. This has led telecommunication firms in Cameroon and Africa at large, to embark on upgrading their technology after a long period of languishing with the 2G network. The paper therefore, set out to examine its impact on service quality and customer satisfaction. Our findings posit that, maintaining high quality to ensure customers' satisfaction and loyalty, in this spectre of fierce competition; is a boundless derivative of technological innovations. Therefore, since acquiring new customers is often substantially more expensive than retaining existing ones; it seems innocuous to recommend that managers should drive more attention to enhancing innovations, which is an antecedent to quality, satisfaction and loyalty.*

Keywords: Technological Innovation, Service Quality, Customer Satisfaction, MTN Cameroon

1. Introduction

The connections that initiated one of the greatest technological transformations in history were made in the 1940s. This has created a wide global market for information and communication technologies (ICTs), laying the foundation for networked readiness. Today, the internet and the utilities it supports have palpable effects on almost every segment of our lives (Bilbao-Osorio, Dutta, & Lanvin, 2013). Consequently, the telecommunication industry now realises an enormous increase in the demand for its services for both private and business motives; since it provides the main and required support services for rapid socio-economic growth and modernisation of other sectors of the economy (Yadav & Dabhade, 2013). We now live in a century where many businesses that go in pursuit of efficiency are being structured to quickly adapt to the rapidly changing ICTs. The quantum leap of technology in the telecommunication industry flanked by a growing market, magnetise adept and belligerent players; who endeavour to dispense wide and innovative services to consumers, at a time that customers' preferences are rapidly changing almost proportionate to the changing technology.

The impact of advancing technology on the socio-economic and political landscape of nations of the world has burgeoned, yet its implications are far from being adequately explored. These technological advances provide computer setups that can alter productivity and employment patterns to a greater degree. The ingredients of such a system are the coexistence, connectivity and standards of voice, data, text, and image with full reliability, availability, maintainability, and above all, ease of use (Muroyama & Stever, 1988; Obadare, 2006).The shift from analogue to digital switching and transmission technologies, has had tremendous impact on efficiency. Satellites and optical fibres, among other technologies contribute significantly to the globalization of telecommunications services.

Beside the core network infrastructures that have grown expeditiously, many other technological advances have developed in the mobile telecommunication industry. There have been many breakthrough technologies in the entire mobile telecommunication ecosystem including components like microprocessors, chips sets, screens, memory audio batteries. With its cumulative effects on innovations in the core network infrastructure leading to enormous diversity which adds new dimensions to customers' experiences. The introduction of the android Operating System(OS) in 2008 following a series of other successful mobile OS like; Apple iOS (2007), Windows OS, Symbian (Nokia), Blackberry OS (1999) has represented one of the greatest breakthroughs in mobile technology. This has greatly transformed the landscape of the telecommunication industry having a tremendous spill over effect in less developing countries particularly in rural areas.

As technology in this industry progresses, it is rapidly absorbed in many countries given that the world has become a global village. Android phones for instance provide a diversity of applications (WhatsApp, Snap Chat, Facebook) that can only be effectively utilised if network services meet international standards. Therefore, telecommunication firms need to constantly upgrade to meet customers' expectations in many sectors such as finance, banking and academia. The number of mobile users also continues to rise rapidly in both rural and urban areas of Cameroon, partly due to the poor condition of the fixed-line network. There were roughly 7.4 million mobile phone subscribers in the country in 2009. Therefore, the competing firms in the telecommunication industry need to provide the appropriate services that meet customers' expectations to gain a larger share of the market. This explains why MTN, a major mobile telecommunication

company in Cameroon; has as vision to "lead the delivery of a bold digital new world" that "make customers life a whole lot brighter" (CameroonWeb, 2017).

Consequently, the twin launch of 3G & 4G network in 2015 by MTN which nearly contributed 14.2% of its total income; positioned itself as a reliable world-class network provider and strategic partner of Cameroon's socio-economic development. By February 2017, the group had more than 3,700 base stations and 05 ultra-modern technical centres; with their services covering closely 93% of the population qualifying her as the leader of the telecommunication industry in Cameroon. These innovations definitely create an impact on their clients that can affect their satisfaction and loyalty. Further, Yadav & Dabhade (2013) purported that service providers frequently place high priority on clients' satisfaction because it has been observed to be a prerequisite to customer retention.

Therefore, the primary objective of this study is to examine the impact of service quality on customers' satisfaction in the mobile telecommunication industry in Cameroon. More specifically, the study seeks to; assess customers' perception on the quality of services provided; examine and quantify the magnitude of clients' satisfaction with the them, investigate customers' loyalty and quantify the impact of service quality on customers' satisfaction.

The current study is relevant from various dimensions; it provides a theoretical explanation to various literatures on technological innovations and an understanding about the practical applications of the theory. It also provides the development of constructs that initiates the course for theoretical improvement. Further, no study known to the researchers has been found in Cameroon that has investigated public perception on the quality of services provided by the mobile telecommunication industry; customer's satisfaction with the services, customers' loyalty and the impact these services exhibit on satisfaction and loyalty. The current study fills the literature gap by examining these in Cameroon; with a view to finding out what consumers' perception might have on their supplier preference. This study no doubt, will serve as a reference material for people researching on technological innovations, service quality and other related issues

The remainder of this paper is structured as follows; part 2 provides an overview of the telecommunication industry in Cameroon showing clearly the trend of development and agents in the sector. Section 3 is devoted to a review of the related literature on service quality. Section 4 explains the approach that underpins the analysis of the data. It describes the research design, population of study, research instrument that form the basis of the research paper. Part 5 presents' empirical results and section 6 draws conclusions.

2. Cameroons' Telecom Industry

The economic crisis of the mid 1980s led the government of Cameroon to adopt the structural adjustment programme under the direction of the World Bank. This aimed at addressing key macroeconomic and sectoral issues that were confronting the country. Accordingly, two basic tenets of the programme included the deregulation of internal commerce; aimed at lowering domestic cost structure, and the restructuring and rehabilitation of the government enterprise and banking sectors (World Bank; 1989). In this light, the government of Cameroon, in 1990 signed an order on the programmed privatisation of public and semi-public enterprises and the telecommunications sector became part of the initiative in 1995. The process took the form of economic liberalisation with a view to creating a favourable environment to develop its infrastructure and services to satisfy its increasing demand; and the telecommunication sector just like any other had to undergo the process (WorldBank, 1989).

The management of telecommunications in Cameroon is under the responsibility of the Ministry of Posts and Telecommunications (MINPOSTEL). Law no. 98/014 governing telecommunications in Cameroon (the Telecommunications Act) was promulgated in 1998.It formed the Telecommunication Regulatory Agency to guarantee and ensure the regulation, control and monitoring of the activities of operators in this sector: the operation of telecommunication networks to operators, regulative matters to a regulatory body, and the definition of sector policy and the enactment of market regulations to the telecommunication administration. In September 1998, the Telecommunication Regulatory Board (TRB) created by the Telecom Act was established with the signing of decree No. 98/197. The Board was assigned three main duties, that is, to ensure that regulations are implemented to guarantee respect for the regulations; and the exercise of competition, and to settle disputes between operators (CameroonWeb, 2017). With all these in place, the telecommunications landscape began to change as the market moved from a state monopoly to a regulated oligopolistic market. Three concession licenses were issued, one to CAMTEL as a fixed line operator and two mobile licenses to MTN Cameroon and Orange Cameroon. This led to modern investments in infrastructure, expansion of existing services and the deployment of new services (Nchadze, 2015).

Consequently, the telecommunications landscape began to change rapidly as the market became a regulated oligopolistic market; with major players having as market strategies both the number of subscribers and their price level. This led to new investments in infrastructure, expansion of existing services and the deployment of new services. Given all these, the telecommunication sector in Cameroon witnessed remarkable progress over the first decade of competition as the volume, quality and variety of services expanded and access charges dropped. Recent developments in the conduct of the major telecommunication operators present new challenges with implications for all actors including service providers, users, potential entrants, and particularly the regulator.

Table 1 shows that Cameroons' mobile cellular telephone subscriptions increased by more than 439 per cent, 175 per cent and 60 per cent; between the periods 2001-05, 2006-

10 & 2011-15 respectively. The number of fixed-telephone subscriptions fell by 5.6 per cent between 2001-05, rose incredibly by more than 312 per cent from 2006-10 & 57 per cent from 2011-15. Further, since MTN Cameroon and Orange Cameroon were permitted to provide internet services, the number of internet users increased extraordinarily; by more than 461 per cent, 134 per cent

and 346 within the periods 2001-05, 2006-10 & 2011-15 respectively. Finally, the number of Fixed-broadband subscriptions can also be seen to have increased by more than 1,314 per cent and 49 per cent between 2006-10 & 2011-15 respectively.

Table 1: Evolution of the Telecom Market in Cameroon, 2000-15

	Period Average			Growth Rates		
Year	2001-05	2006-10	2011-15	2001-05	2006-10	2011-15
M-cellular telephone subscriptions	1195835.6	6094722.2	14667309	439.787	175.408	60.27
Fixed-telephone subscriptions	102866.2	309958.2	862352	-5.604	312.799	57.703
Internet users	126747.3	651586.14	2161286.6	461.326	134.675	346.041
Fixed-broadband Subscriptions	-	1755	14741.4	-	1314.25	49.351

Major Players in the telecommunications market in Cameroon include MTN, ORANGE, NEXTTEL, YOOME, CREOLINK, CAMTEL, EQUACOMM, FORIS CAMEROON, VODACOM, RINGO.

MTN, ORANGE AND NEXTTEL are mobile-phone companies; their services operate through mobile Internet modems. They are still "ISP intermediaries" because their internet connection is provided to them by CAMTEL. It is through these two suppliers that most Cameroonians have Internet access (CameroonWeb, 2017). MTN is perhaps the most important telecommunications network in Cameroon and the Central African sub-region. It had nearly 9.9 million subscribers on 31 December 2016 out of Cameroons' population of 21 million with a national coverage of close to 93 per cent; its client services were certified ISO 9001:2008 by SGS in 2014 in recognition of its continuous efforts to provide the best quality of service possible to its customer. In 2015, MTN upgraded to 3G and 4G LTE which definitely has had an impact on their clients. These and more are subject to investigation in the current study.

3. Literature Review

Many theories have been propounded that explain technological innovations in relation to customer satisfaction. The current study is grounded in the theory of creative destruction proposed by Schumpeter 1942 who considered it "the essential fact about capitalism". He argues that innovations are fundamental gales of creative destruction that drive growth in capitalist economies. Accordingly, entrepreneurs who work independently or in large corporations create opportunities for new profits with their innovations. The existence of large profits created by the innovations attracts sundry imitators sparking a wave of new investments until all abnormal profits are wiped out. Nonetheless, prior to arriving at this equilibrium situation, an innovation would have emerged to begin another cycle which keeps going perpetually. He initially assumed that innovations were exceptional to some individuals who were willing to take on some hazards as "an act of will"; envisaged growth to be only dependent on innovations without considering other factors like market size, investment. Further, Schumpeter did not bring out the source of innovation which prompted Keynesian

economists to argue that investment was a prime course of innovation. However, the theory remains relevant for its unequivocal idea that; new technology replaces old technology endlessly as can be observed, which is better because new technology adds value to the adopter. This restructuring permeates all aspects of industry's performance and could be a major source of instability and market performance. These have serious implications on service quality, user acceptance and ease of use. The overall expectation is that innovations improve service quality and satisfaction. Haltiwanger and Schuh (1996) showed the empirical evidence of this theory in the US by documenting and characterising large magnitude of job flows in the manufacturing sector. They concluded that over 10% of jobs that exist at any point in time did not survive a year before or will not exist a year later.

Empirically, a surfeit of studies on service quality, service innovation and their impact on customers' satisfaction and loyalty have been carried out in various dimensions of the social sciences including health, education, banking & finance and telecommunication services. Yet, much remains to be illuminated particularly in the mobile telecommunication sector that is embracing rapid technological innovations at a time that their customers are properly informed about better alternatives in the market. Thus, service quality is a vital ingredient of telecommunication services.

Further, the quest for greater market share remains paramount in this era of stiff competition in the telecommunication industry. Many players in the sector are obsessed with finding how to meet up with the immense demands. Consequently, firms in the market go in pursuit of ways to gain more customers by offering highly competitive packages to utility maximising consumers (Woo & Fock, 1999). To this effect, Vranakis et al., (2012) cites Kotler (1982) whom purported that these firms have as major objective to increase customers' satisfaction in order to enforce loyalty and build a long-term client relationship. In a competitive market, service providers are expected to compete on both price and quality of services; it is also necessary for the service providers to meet the consumers' expectations to either maintain or improve on their satisfaction. Further, a majority of customers purchase services from mobile telecommunication firms' mainly for instant

communication; therefore, quality of services rendered by firms can shape consistency of purchasing the product from a particular player in the market. A critical success factor for a firm that want to compete, survives and maximise its payoff is therefore to deliver quality services than the rival firm can do (Paulrajan & Rajkumar, 2011).

Adilaka, Chalitaa, & Vinaia (2016) cites Cronin & Taylor (1992) and Teas (1993); who defined perceived service quality as a customers' judgment of the overall excellence or superiority of certain service provider's performance. Accordingly, it's characterised by 6 key elements: (1) network coverage (2) value-added services (3) customer support services (4) convenience in procedures, (5) services in campaigns and (6) pricing structure. Consequently, perceived service quality is to be evaluated from the recognition of good or superior performance in terms; promotional advertising, services delivery, good coverage and clear signalling, after-sales service, and cost of services.

Many studies highlight the importance of quality on the demand for mobile telecommunication services and agree that quality improvements result in increases in levels of customers' satisfaction and loyalty. Therefore, it is vital to identify those factors that have the greatest impact on quality and consequently customers' satisfaction. More recently, a study by Adilaka et al., (2016) on an analysis of mobile customers' satisfaction in Thailand employed a sample of 460 users of mobile services for both prepaid and post-paid across the region. In this study, the data collected was analysed with descriptive statistics, Chi-square with contingency efficiency value and multiple regression analysis (MRA). The estimated regression model indicated that perceived service quality was positively associated with the mobile customers' satisfaction.

Structural Equation Modeling (SEM) is perhaps one of the most widely used technique in empirical works by researchers and practitioners; to analyse the interrelationship among variables in the model and it's very popular on studies relating to service quality and customers' satisfaction (Vranakis, Chatzoglou, & Mpaloukas, 2012; Huang & Kaewmee, 2011; Shau, 2017). Nasir & Mushtaq (2014); Yadav & Dabhade (2013); Vranakis et al., (2012); Almossawi (2012), Paulrajan & Rajkumar (2011) employed this technique in their empirical investigations and found that service quality has a positive effect on customers' satisfaction. Moreover, in this ever changing technological world with likely assortments of complements from competitors, either service quality is an antecedent of technical innovation or both are concurrent. Consequently, maintaining high quality to ensure customers' satisfaction and loyalty in this spectre of fierce competition is a boundless derivative of technological innovations. Therefore, innovation is critical to the success of mobile telecommunication firms in this rapidly changing business environment if quality services have to be rendered sustainably (Osei & Owusu, 2015).

The pressure to find better ways to do business continues to be on an exponential increase. The increasingly global telecommunication landscape now poses a competitive challenge, but also provides a new way for business burgeoning. Addressing these challenges and opportunities craves the provision of quality service (IBM, 2010). Accordingly, technological innovation is seen as a fundamental factor that shapes a firm's competitive advantage as well as a vital element in improving performance. Huang & Kaewmee (2011) examined the impact of service quality and service innovation on technology acceptance model. They used the maximum likelihood estimator of Structural Equation Modeling to analyse data collected from Thailand international air passengers. Their results showed that service quality and service innovation had significant relationships with ease of use. Service innovation impacted positively on usefulness and status, but service quality did not. Gebauer, Gustafsson & Witell (2011) also find that service innovation positively impacts on firms' customers' satisfaction. Therefore, customers' satisfaction is another vital component of a firms' survival that needs meticulous investigation particularly in the telecommunication industry in Cameroon that has recently undergone major technological innovations.

"Customers' satisfaction is a feeling of either pleasure or disappointment resulting from the evaluation of services provided by an organisation to an individual in relation to the expectations" (Yadav & Dabhade, 2013). In their analysis of mobile customers' satisfaction, Adilaka et al., (2016) highlight four key components of customers' satisfaction: satisfaction with the service, overall satisfaction with the network, conformity with pre-purchase expectations of the customers and expectations and standards that have been in service (conformity with expectations). Many empirical works have established a positive impact of service quality on customers' satisfaction. In a study carried out in India to understand the influence of service quality on consumers' preference of cellular mobile service providers; Paulrajan & Rajkumar (2011) showed that communication and price were influential and most preferential factors in selecting telecommunication service providers. Further, product quality and availability had a significant impact on consumer perception choice in selecting cellular mobile service provider. In this study, they also showed that customers' satisfaction affects to a great extent customers' loyalty. Unfortunately, very few of these empirical studies have been carried out in Cameroon that relates service quality with customers' satisfaction. An in-depth analysis of service quality in relation to customers' satisfaction in Cameroons' telecommunication industry is therefore fundamental to contribute to the literature; and in designing policies that can improve on customers' experiences.

4. Theoretical Framework and Methodology

The theoretical framework of this piece of research is rooted in the theory of utility maximisation, very similar to those used in previous investigations. A substantial number of empirical works have employed econometric analysis to study customers' satisfaction of services (Xesfingi & Vozikis, 2016; Amponsah & Hiemenz, 2009;

Schoefelder, Klewer & Kugler, 2011; Kaija & Okwi, 2011). Although, very few of these studies on customers' satisfaction in the telecommunication sector have applied the logit model (Khayyat & Heshmati, 2012; Anand & Bansal, 2016). A substantial number of them tends to employ Factor Analysis[FA], Multiple Regression Analysis[MRA] and Structural Equation Modelling[SEM] (Vranakis et al 2012; Almossawi, 2012; Huang & Kaewmee, 2011). Significant evidence in the literature proves that newer and more statistically appropriate methods like CHAID, logit, log-liner models provide more acceptable and reliable results compared to the conventional approaches (Anand & Bansal, 2016). Consequently, the logit model was considered appropriate for this study most importantly because of its simpler computationally and findings can easily be interpreted and generalized.

Logistic regression answers basically the same questions as discriminant analysis; the logit form of multiway frequency analysis with a discrete dependent variable and multiple regression analysis with a dichotomous dependent variable. However, logistic regression is more flexible than the other techniques. Unlike discriminant analysis, logistic regression makes no assumptions about the distributions of the explanatory variables. Consequently, the explanatory variables do not need meeting strict stipulations of normality, linearity and homoscedasticity. Unlike multiway frequency analysis, the predictors do not need being discrete. The predictors can be any mix of continuous, discrete and dichotomous variables; unlike multiple regression analysis, which also has distributional requisites for predictors, logistic regression cannot produce negative predicted probabilities. (Tabachnick & Fidell, 2007)

The likelihood of a certain customer being satisfied with services rendered by a particular telecommunication firm can be described by a logit model; which is expressed as a nonlinear function of explanatory variables as follows:

$$Prob(y_i = 1/x_i = P_i = \gamma(x'_{ij}\beta_j) = 1)(1)$$

where the endogenous variable y_i is the degree of a customer's satisfaction and takes the value 1, if the customer is satisfied with a certain quality of service rendered by the mobile telecom firm, and 0 if otherwise(dissatisfied); γ is the standard logistic cumulative distribution function and x_i is a set of covariates(Xesfingi & Vozikis, 2016).

The inverse of the function $P_i = \gamma(x'_{ij}\beta_j)$ specifies the function of the probability that is linear in the explanatory variables i.e. $\gamma^{-1}(P_i) = x'_{ij}\beta_k$ CITATION Fre04 \l 1033 |(Frees, 2004)}. Therefore, this transformation gives us a linear regression model of the form:

$$y_i^* = \beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j + \mu_i \ (2)$$

In (2), y_i^* is an unobserved variable commonly called a "latent variable" hence we interpret it as the "propensity" to possess a particular attribute utility (satisfaction) from

consuming a certain quality of service. What we actually observe is a dummy variable y_i commonly defined by:

$$y_i = f(x) = \begin{cases} 1, & if \ y_i^* > 0 \\ 0, & Otherwise \end{cases} (3)$$

(Maddala, 1992) purports that if we observe y_i, we can estimate the β_s in (2) only up to a positive multiple hence its customary practice to assume that the variance is homoscedastic in other to fix the scale of y_i^*. Therefore, the relationship in (2) & (3) can be transformed to have;

$$p_i = Prob(y_i = 1) = Prob[\![\mu_i > -(\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_{ij}]\!]$$
$$= 1 - \gamma[-(\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j],$$

γ is the cumulative distribution function of μ, if the random disturbance term follows a symmetric distribution and since $1 - \gamma(-Z) = \gamma(Z)$, this implies we can write;

$$p_i = \gamma(\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j) \ (4)$$

From (4), the likelihood function can be written as:

$$L = \prod_{i=1}^{ni} P(Y_i / X_i, \dots X_{ij}) \qquad =$$
$$\prod_{i=1}^{ni} [(\frac{e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j}}{1 + e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j}} \cdot (\frac{1}{1 + e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j}})]^{1-Y_i} \ (5)$$

Where Y_i is the dummy variable for the ith case and $X_{i1} \dots X_{ij}$ are the values of the predictor variables for the ith case based on a sample of n cases(Josephat & Ismail, 2012). Hence,

$$Log \ \frac{e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j}}{1 + e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j}} = e^{\beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j} \ (6)$$

It can therefore be readily observed that the logit model takes the form;

$$log \ \frac{\rho_i}{1 - \rho_i} = \beta_0 + \sum_{j=1}^{k} x'_{ij}\beta_j,$$

The left hand side is the log-odds ratio which is a linear function of the explanatory variables. Therefore, the logit of a probability is simply the log of odds of the response taking the value 1; which is the predicted conditional utility evaluated at x'_{ij}. Any real value can fit in the logit function, and the associated probability will always lie within the interval [0,1]. Anand & Bansal (2016) stated that the parameter β_j associated with x'_{ij} is such that $\exp(\beta_j)$ is the odds that the response variable takes the value 1 when x'_{ij} increases by 1, conditional on the other variables remaining constant.

5. Research Setting and Data Collection

The data set used in this investigation was collected through a self-administered questionnaire during the period of April to June 2017. The study employed a survey

research design and covered the entire Buea municipality (Buea Sub Division). Study participants were randomly selected based on their gender, age, occupation; and the selection criteria included only respondents who had used MTN services for at least three years, prior to upgrading to 3G and subsequently 4G LTE technology. Respondents consent was requested before administering the research instrument, participation was voluntary and personal information classified. A total of 520 questionnaires was printed and distributed; 363 surveys were completed and returned, resulting in a response rate of 70 percent. Out of the 363 returned questionnaires, 63 were judged inappropriate for the analysis because of multiple problems which included missing data and inconsistency in the answers. Therefore, only 300 surveys were analysed implying an effective response rate of 58 percent.

The 40-item questionnaire inquired about clients' demographics and quality of their service providers. The instrument also collected data regarding customer satisfaction, customer loyalty, network coverage and signal quality, perceived value, and customer service as shown on table 2. These items were designated as ordinal variables, and rated in a 5 Point-Likert scale (1-Strongly Disagree & 5-Strongly Agree).

The internal consistency of the scales was verified using the Cronbach's Alpha. Many researchers have argued as to what benchmark should be considered when checking the internal consistency of a particular scale. While others take a benchmark of ≥0.7 (Pallant, 2005; Ho, 2006). Many others consider from 0.6 (Shau T. V., 2017; Al-Hawary & AlDafiri, 2017; Vranakis, Chatzoglou & Mpaloukas, 2012). others argue that the Cronbach's Alpha value of 0.7 is too high as it is quite common to find low Cronbach values of ≤0.5 in empirical studies. This occurs especially with scales fewer than ten items. It may in this way be more appropriate under such circumstances to report the mean inter-item correlation for the items. Briggs and Cheek (1986) therefore recommend an optimal range for the inter-item correlation of 0.2 to 0.4(as quoted in Pallant, 2005).

Table 2: Description of Variables

Variable	Description	Mean (S.D)	Cronbach's Alpha	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Customer Satisfaction(DV)	Transformed		0.758				
Network Satisfaction	1 if Agree; 0=Otherwise	0.77[.42]		5.6067	3.263	0.581	0.682
Service Satisfaction	1 if Agree; 0=Otherwise	0.58[.49]		5.9333	2.979	0.621	0.635
Expectations	1 if Agree; 0=Otherwise	0.57[.49]		6.1333	3.293	0.560	0.705
Customer Loyalty(DV)			0.671				
Intention to leave MTN	1 if Agree; 0=Otherwise	0.68[.47]		3.4267	1.269	0.515	
Use more services	1 if Agree; 0=Otherwise	0.77[.42]		3.1167	1.869	0.515	
Service Innovation	Transformed		0.714				
Up-to-date Minute technology	1 if Agree; 0=Otherwise	0.87[.34]		6.4433	3.351	0.493	0.672
Service Speed	1 if Agree; 0=Otherwise	0.80[.39]		6.7667	3.504	0.549	0.611
Complain Resolution	1 if Agree; 0=Otherwise	0.70[.46]		7.0767	2.927	0.565	0.585
Network Coverage & Signal Quality	Transformed		0.621				
Geographical Coverage	1 if Agree; 0=Otherwise	0.66[.48]		5.7533	3.484	0.638	0.574
Call Drop Rate	1 if Agree; 0=Otherwise	0.60[.49]		5.9333	3.996	0.541	0.690
Voice Quality	1 if Agree; 0=Otherwise	0.56[.49]		5.8933	3.741	0.532	0.703
Perceived Value	Transformed		0.683				
Accurate Billing System	1 if Agree; 0=Otherwise	0.84[.37]		10.0333	6.467	0.502	0.568
Affordable Charges	1 if Agree; 0=Otherwise	0.69[.46]		10.76	7.802	0.320	0.683
Promotional Packages	1 if Agree; 0=Otherwise	0.79[.41]		10.4667	6.651	0.487	0.580
Customer Service	Transformed		0.63				
Working Hours	1 if Agree; 0=Otherwise	0.84[.37]		6.3067	3.123	0.451	0.517
Complain Resolution	1 if Agree; 0=Otherwise	0.77[.42]		6.4733	2.745	0.501	0.440
CRM	1 if Agree; 0=Otherwise	0.65[.48]		7.000	3.237	0.371	0.624

Cronbach's Alpha values for the individual scales presented in table 2 were at least .621, which indicated overall internal consistency of the various scales. The Corrected Item-Total Correlation shows the correlation between each item and the sum of the remaining items. In deciding which item to maintain or delete, the 0.33 criterion was employed (An item-total correlation of 0.33 indicates that approximately 10% of the variance in the scale is accounted for by that item). Based on this criterion, items were progressively reduced from the scale till the scale became reliable. Indeed, any further deletion of any of the items on table 2 will reduce the overall reliability of the scale remarkably; as indicated by the column Cronbach's Alpha if Item Deleted. During the analysis, the 5-point ordinal scale was finally collapsed into a dichotomous variable (One if Agree, zero ifs otherwise, Disagree). SPSSv21 and Stata12 software's were used to run the analysis.

6. Empirical Results

Customers' Perception on the Quality of Services Provided

The study sought to investigate the role of technological innovations, service quality and customer satisfaction in Cameroons mobile telecommunication industry. This section presents descriptive statistics from our study. Table 3 shows that 57.3% of the respondents were satisfied with the network coverage while 42.7% were not. 77% of the respondents were satisfied with the quality of the services rendered while 23% were not. Finally, 58.3% of the respondents agreed that their expectations were being met while 41.7% reported that their expectations were being unmet by the service provider. Generally, most of the customers were satisfied. Further, startling results on customer loyalty show that; 68% of the respondents would leave the network if they had a better alternative while only 32% do not plan to leave the network. Quite a large number of customers than expected are still not satisfied even after technological innovations craving that the descriptive results should be subjected to meticulous analysis. It can also be observed that 77% of the respondents plan to use more services and only 23% do not.

Table 3: Customers Satisfaction

	Customer Satisfaction(DV)					
	Network Satisfaction		Service Satisfaction		Expectations	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Disagree	128	42.7	69	23	125	41.7
Agree	172	57.3	231	77	175	58.3
	Customer Loyalty(DV)					
	Intention to leave MTN				Use more services	
Disagree	96	32			69	23
Agree	204	68			231	77

Table 4 presents findings on service innovation, network coverage & signal quality. Perceived value and customer service. It can be observed that 87% of the respondents agree that MTN provides up to date minute technology, 80.3% share the opinion that internet services are very fast; while 70% of the customers reported that complaints are resolved timely. Therefore, a significant proportion of the respondents are of the opinion that innovations have been made; that has improved on the quality of the network when compared to the previous 2G network. This should have serious implications on customer satisfaction.
Further, 65.7% of the respondents reported the network had a good geographical coverage, 60% reported that the network transmission quality is good; while 56.3% agreed the voice quality of MTNs Network is good. Therefore, the findings purport to show that the network coverage and signal quality of the telecommunication firm is good.

Descriptive results on perceived value show that 68.7% of the respondents reported that MTN has an accurate billing system; 84% are of the opinion that the charges are affordable while 78.7% of the respondents were of the opinion that MTN offers attractive promotional packages. These stimulate customer satisfaction.

Finally, customer service was analysed based on working hours and customer relationship management. 84% of the respondents agreed that the working hours are good while 65.3 were also of the opinion that their customer relationship management is good. Improved Customer satisfaction, customer loyalty, network coverage & signal quality. Perceived value and customer service can be seen as antecedents of technological innovations.

Table 4: Quality Indicators

Service Innovation							
Up-to-date Minute technology			Service Speed			Complain Resolution	
	Frequency	Percentage	Frequency	Percentage		Frequency	Percentage
Disagree	39	13.0	59	19.7		90	30.0
Agree	261	87.0	241	80.3		210	70.0
Network Coverage & Signal Quality							
Geographical Coverage			Transmission Quality			Voice Quality	
Disagree	103	34.3	120	40.0		131	43.7
Agree	197	65.7	180	60.0		169	56.3
Perceived Value							
Accurate Billing System			Affordable Charges			Promotional Packages	
Disagree	94	31.3	48	16.0		64	21.3
Agree	206	68.7	252	84.0		236	78.7
Customer Service							
Working Hours						CRM	
Disagree	48	16.0				104	34.7
Agree	252	84.0				196	65.3

Effects of Service Quality on Customer Satisfaction

In this section, we present the results of the effects of service quality on customer satisfaction in Cameroons' mobile telecommunication industry based on the logit model. We present the odds ratios on measures of service quality which include signal quality & network coverage, perceived value, customer service and service innovation. Table 5 and Table 6 presents the odds ratios for all specifications. Accordingly, if the odd ratios >1, then the odds in favour of a customer being satisfied, i.e. Y_i = 1increases, while it decreases if odd ratios <1. Columns (1) (2) & (3)in table 5 present different measures of customers' satisfaction as predicted by service quality.

Signal Quality and Network Coverage: Signal quality & network coverage was segmented into three; geographical coverage, call drop rate and voice transmission/reception quality. The results generally conformed to our expectations. Geographical coverage was the most vital determinant of market strength of MTN Cameroon. The network covers the entire national territory reaching out to an estimated 93% of the market. Therefore, the availability of the network services "Everywhere You Go" has made it the most preferred telecommunication firm in Cameroon. Prior to upgrading to 4G LTE technology, drop rate of calls use to be highly frequent and the voice transmission quality was also very poor. Significant progress has been made with the innovations that has enhanced the signal and network quality, this has enormously contributed to the satisfaction of customers with the services. The current results seem to corroborate previous research (Paulrajan & Rajkumar, 2011). Generally, improvements in signal and network quality increases network satisfaction, service satisfaction and also makes customers to realise their expectations. On the other hand, the findings contradict recent audit results by Cybercom Global Organisation in Cameroon which lamented on the degradation of service quality offered users by all operators. This was based on the fact that while the 3G coverage has an internationally acceptable standard of 3.8, most towns in Cameroon operate at less than three and many others even less than two. Conversely, any marginal improvement in quality as has been observed bolster customer satisfaction to a much greater level.

Perceived Value: With respect to the perceived value indicators, all coefficients of its results were statistically insignificant which do not conform with our expectations. Customers constantly realise unexpected cuts in their airtime after making calls which make them to judge that the billing system may be inaccurate. Sometimes, customers subscribe to temporary promotional packages which when they expire, the network provider does not remind them; but automatically revert to a previous exorbitant tariff plan. This has frequently been realised in internet subscription; as network suppliers automatically start billing from the main account when there is no more data bundle left. Charges on MTN services are also usually discriminatory. This reason explains why customers constantly migrate from one SIM Card to another to get a better plan, benefit from discriminatory promotional packages with newer SIM Cards; while maintaining a permanent line for their contacts. Further, the odds in favour of being satisfied given a unit increase in promotional packages increases by 1.4. More specifically, the probability of a customer being satisfied given a unit increases in promotional packages will be 40% higher. Therefore, attractive promotional packages are likely to stimulate customers' satisfaction with the telecommunication services. Overall, customers do not seem to realise an improved value from the services obtained from their network provider in terms of network satisfaction, service satisfaction and their expectations. The findings seem to conform with the outcome of the audit by Cybercom Global Organisation which reiterated on the weak technical role played by the Telecommunication Regulatory Board. They observed that there were technical lapses regulating their equipment's, the non-respect of international standards and the spreading of non-optimised networks.

Customer Service: Customer service was also segmented into three i.e. working hours, complain resolution and customer relationship management. The empirical findings were in agreement with our expectations. Customer service is perhaps one of the most important determinants of customers' satisfaction. Having high-quality products with little working hours, poor strategies to resolving complaints and inappropriate customer relationship management particularly in a private business organisation can stifle customers. The odds in favour of being satisfied

decreases with additional working hours. Following the introduction of mobile money services and the user-friendly online platform, many services can be reached at from customers bed rooms; rendering them almost indifferent to working hours since there is increasingly little requirement for face to face transactions. Complaint resolution is the most important customer service with odds in favour of customers being satisfied; following the introduction of a more effective complaint resolution system being higher by 17.3 units (1630% higher). The network system has been developed in a user-friendly manner that provides answers and guidance to all frequently asked questions, and readily available agents on standby for further technical difficulties. Nonetheless, quite a good number of respondents reported the agents hardly responded to their calls which may be a call for concern. Therefore, the operator needs to carry more investment to meet up with the increase in the number of subscribers. Overall, customer service is a vital determinant of network satisfaction in Cameroons mobile telecommunication sector; and also improve service satisfaction, make customers' expectations to be realised as shown by the odds ratios>1.

Service Innovation: Service quality is either an antecedent of technological innovation or both are concurrent. Either way, it was measured using items which asked whether the network provider provides up to date minute technology, speed of the services rendered and complain resolution. The results were in conformity with the expectations, the odds in favour of being satisfied following an increase in the speed of services (e.g. internet speed) will increase by 1.9(i.e. higher by 90%). Generally, service innovation improves network satisfaction, service satisfaction and lead to realised expectations since most of the odds ratios are >1. 68% of all cases were assigned correctly with a Nagelkerke R^2 of .632 for model 1; 77% of all cases were assigned correctly, with a Nagelkerke R^2 of .431 for model 2; and finally, 73.3% of all cases were assigned correctly, with a Nagelkerke R^2 of .379. Therefore, the findings agree with the empirical literature (Osei & Owusu, 2015)

Table 5: Service Quality and Customers' Satisfaction

Variable	Indicator	Network Satisfaction (1)			Service Satisfaction (2)			Expectations (3)		
		OR	95% CI	PV	OR	95% CI	PV	OR	95% CI	PV
Signal Quality & Network Coverage	Geographical Coverage	35.5	11.2-112	0.00	3.1	1.3-7.3	0.01	1.6	0.8-3.2	0.17
	Call Drop Rate	2.4	0.9-6.1	0.07	4.1	1.8-9.3	0.00	1.2	0.6-2.3	0.56
	Voice Quality	0.1	0.0-0.2	0.00	0.1	0.0-0.2	0.00	2.9	1.5-5.8	0.00
Perceived Value	Accurate Billing System	0.9	0.3-2.8	0.92	3.6	1.4-9.6	0.01	1.6	0.6-4.3	0.32
	Affordable Charges	0.9	0.4-2.6	0.96	0.7	0.3-1.7	0.49	0.6	0.3-1.3	0.22
	Promotional Packages	1.4	0.5-4.1	0.53	1.1	0.4-2.7	0.88	1.9	0.9-4.3	0.09
Customer Service	Working Hours	0.2	0.1-.8	0.02	0.9	0.3-2.3	0.77	2.5	1.1-5.9	0.04
	Complain Resolution	17.3	5.3-56.3	0.00	2.3	0.9-5.9	0.08	1.5	0.7-3.2	0.33
	CRM	2.9	1.3-6.7	0.00	1.8	0.8-3.9	0.14	1.5	0.7-2.9	0.29
Service Innovation	Up-to-date Minute technology	4.2	1.1-15.8	0.04	2.6	0.8-8.5	0.10	13.1	3.6-47.3	0.00
	Service Speed	1.9	0.6-5.7	0.06	0.8	0.3-2.2	0.60	0.6	0.3-1.4	0.22
	Complain Resolution	6.1	2.5-14.9	0.00	5.8	2.5-13.5	0.00	2.2	1.1-4.3	0.02
n=300		NagelkerkeR^2=.632			NagelkerkeR^2=.431			Nagelkerke R^2=.379		
		x^2, 12=180.052 (Sig=0.00)			x^2, 12=100.288 (Sig=0.00)			x^2,12=99.35(Sig=0.00)		
		-2log likelihood: 196.070			-2log likelihood: 223.28			-2log likelihood; 310.062		
		68% of all cases were assigned correctly			77% of all cases were assigned correctly			73.3% of all cases were assigned correctly		

Effects of Service Quality on Customer Loyalty

New emphases in modern marketing are now being directed to customer retention instead of customer acquisition in order to create long lasting relationships with customers (Moreira, Silva & Moutinho, 2017). Signal quality & network coverage, perceived value, customer service and service innovation were employed as predictors of customers' loyalty.

Findings on signal and network quality on customers' intention to leave MTN network were generally in conformity with our expectations. Geographical coverage and call drop rate were significant determinants of customer's plans to use more services. Overall, the results show that customers will become loyal given improvements in signal quality and network coverage. Perceived value was expected to positively affect customer loyalty if the overall service value received worth more

than the money paid to lead to repurchasing or customers' savings. Findings on perceived value and customer service were not associated with customers' intention to leave or plans to use more services. It should be noted the study was carried out at a time that customers had frequently experienced internet cuts; because of political upheavals in predominantly English speaking regions of Cameroon. Consequently, such intentions to leave the network for better alternatives weren't astounding.

Service innovation is perhaps a better predictor of customer loyalty as shown by the odds ratios on up to date minute technology, service speed and complain resolution which are significantly associated with customers plans to use more services. Further, any innovation lessens the intention to leave the network as customers prefer to enjoy the improved services. 86.3% of all cases were assigned correctly while the Nagelkerke R^2 resulted in .455 for model 4 while 70% of all cases were assigned correctly and the Nagelkerke R^2 was .288 for model 5.

Table 6: Service Provision and Customers' loyalty

	Indicator	Use more Services (4)			Intention to Leave (5)		
		OR	95% CI	PV	OR	95% CI	PV
Signal Quality & Network Coverage	Geographical Coverage	1.443	0.7- 3.6	0.028	0.893	0.48-1.71	0.733
	Call Drop Rate	0.444	0.2-1.1	0.077	3.183	1.72-5.91	0.000
	Voice Quality	0.565	0.2-1.4	0.226	2.521	1.35-4.72	0.004
Perceived Value	Accurate Billing System	0.95	0.4-2.6	0.920	0.609	0.247-1.5	0.281
	Affordable Charges	0.852	0.4-1.9	0.710	1.46	0.76-2.79	0.254
	Promotional Packages	1.469	0.6-3.9	0.437	1.22	0.58-2.57	0.600
Customer Service	Working Hours	1.945	0.7-5.2	0.183	3.849	1.69-8.78	0.001
	Complain Resolution	2.91	1.1-7.8	0.033	0.881	0.42-1.84	0.737
	CRM	1.699	0.8-3.9	0.207	1.045	0.53-2.08	0.901
Service Innovation	Up-to-date Minute technology	15.622	4.9-49.9	0.000	4.578	1.59-13.18	0.005
	Service Speed	1.512	0.6-4.1	0.041	1.031	0.48-2.22	0.938
	Complain Resolution	6.061	2.8-13.3	0.000	1.348	0.70-2.59	0.371
n=300		Nagelkerke R^2=.455			Nagelkerke R^2=.288		
		x^2, 12=106.98 (Sig=0.00)			x^2,12=72.099(Sig=0.00)		
		-2 log Likelihood:216.577					
		86.3% of all cases were assigned correctly			70% of all cases were assigned correctly		

7. Conclusions

There is no doubt that mobile telecommunication has lulled all and sundry into an excited stupor that has radically transformed the social landscape of nations. Today the internet and the utilities it supports have palpable effects on almost every segment of our lives. Its impact on social democratic activism since November 2016 is almost dumping Cameroon into a gloomy economic prognosis. MTN Cameroon is perhaps the most important telecommunication network in the country and the Central African sub-region. It had close to 9.9 million subscribers at 31 December 2016, out of Cameroons' population of 21 million with a national coverage of close to 93%.

Their recent technological innovations have bolstered customers' experiences, after languishing in obscurity for many years which is fast fading into oblivion. Consequently, the desire for better services has sprung up due to globalisation and competition posed by new entrants to the industry. Therefore, MTN needs to embellish its services by carrying out sufficient investments to meet up with the demands of the expanding number of subscribers; respect international standards to reap more from the burgeoning communication industry in Cameroon and Sub-Saharan Africa where it now predominates.

While we cannot overstate the importance of mobile telephony as enthused by subscribers and the quantum leap in the number of subscriptions; the previous section has

made it lucid, that innovation is critical to the success of telecommunication firms. This discourse, therefore, transcends that management should drive more resources towards innovative investments. Considering service quality, we found support for the idea that signal quality & network coverage, customer service and service innovation stimulate quality and are incentives to customers' satisfaction. Further, cognisant of the fact that the growth of the mobile-phone usage and applications especially among unemployed graduates is higher in Cameroon than in many western countries; which seem to contradict their arduous economic situation; prospects in the industry remain ironclad. Therefore, innovative choices responding to demand should aim at shrinking call drop rates and improving voice quality, internet speed and complaint resolutions. This would have glittering effects on consumers, boosting satisfaction and loyalty.

Since acquiring new customers is often significantly more expensive than retaining existing ones, management should drive much attention to improving customers' loyalty. This should be achieved when quality services and good customer relationship management is developed; and innovations that meet the needs of the consumers in this market with pervasive competition are introduced. Service providers should also ensure to develop an accurate billing system, provide services at affordable charges and provide attractive promotional packages.

In addition, providing services to all citizens without discrimination as recently observed in Cameroon with frequent internet cuts due to political crisis; in predominantly English Speaking Regions of the North West and South West only exacerbate customers' satisfaction. This makes them prone to switching to a better, reliable and trust worthy alternative at the least opportunity. Mobile telecommunication should enhance social democratic activism especially in countries with low scores on freedom of expression. Therefore, playing politics with the service only dampen customer's trust who expect multinationals to be a major voice of the voiceless in this strategic sector.

These results are encouraging, albeit further issues need being addressed. One aspect that should be developed further is an examination of customers' trust, on which the issue of uncertainty lies. In addition, carrying out a more detailed investigation that targets all of the CEMAC region or Sub-Saharan Africa could broaden the scope to ease generalisation of the findings. These are subject to future investigations.

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