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

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Abstract

The article investigates technological innovations, service quality and Customer Satisfaction in Cameroons' Mobile Telecommunication Industry. A survey research design was employed and the data set used in the study was collected through a self administered questionnaire during the period of April to June 2017. The theoretical framework of the study is rooted in the concept of utility maximisation by consumers which is described by the logit model. Our findings show that signal quality and network coverage, customer service and service innovation exhibit significant effects on customers' satisfaction and loyalty. Service innovation is the most important determinant of customers' loyalty. 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. Since acquiring new customers is considerably more expensive than retaining existing ones, telecommunications firms should drive more attention to improving customers' loyalty and satisfaction.

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

Introduction

The connections that initiated one of the greatest technological transformations in history were made in the 1940s; creating a wide global market for information and communication technologies (ICTs) and laying the foundation for networked readiness. Today the internet and the services it supports has palpable effects on almost every segment of our lives (Bilbao-Osorio, Dutta, & Lanvin, 2013). Consequently, the telecommunication industry now realise an enormous increase in the demand for its services for both private and business motives since it provides the main support services that are required 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 seek to be efficient are being structured to quickly adapt to the rapidly changing information and communication technologies. The advancement of technology in the telecommunication industry alongside an ever growing market attracts competent and belligerent players who seek to provide consumers with wide and innovative services 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 advancements provide computer systems that can alter productivity and employment patterns to a greater degree. Powerful computers, advanced software, and fast and reliable communications represent all the basic technologies necessary for a modern information system. The ingredients of such a system will be the coexistence, connectivity, interworking, and standards of voice, data, text, and image with full reliability, availability, maintainability, and above all, ease of use (Muroyama & Stever, 1988).

Nowadays, three main applications of information technologies dominate the telecommunications landscape. These include the normal voice telephone, mobile telephone and data communication with the normal telephone being the driving force of information technologies. The shift from analog to digital switching and transmission technologies has had tremendous impact on efficiency as the telephone network now becomes an integrated service network which has been made possible by dramatic advances in device and material technology. 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 has been a lot of breakthrough technology in the entire mobile telecommunication ecosystem including components such as microprocessors, chips sets, screens, memory audio batteries. With its cumulative effects on innovations in the core network infrastructure leading to enormous diversity which add new dimensions to customers' experiences. The introduction of the android Operating System(OS) in 2008 following a series of other successful mobile OS such as Apple iOS (2007), Windows OS, Symbian (Nokia), Blackberry OS (1999) has constituted one of the greatest breakthroughs in mobile technology that has transformed the landscape of the telecom industry having a prodigious spillover 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 multiplicity of applications (WhatsApp, Snap Chat, Facebook) that can only be effectively utilized if network services are standard. Therefore, network providers need to constantly upgrade to meet customers' expectations in many sectors of Cameroons' economy such as finance, banking, academia (Universities). The number of mobile users also continue to rise rapidly every day in both rural and urban areas of the country, 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 telecom industry need to provide the appropriate services that meet customers' expectations to gain a larger share of the market; partly why MTN, a major mobile telecommunication network 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 contributed nearly 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 centers with their services covering close to 93% of the population qualifying her as the leader of the telecom industry in Cameroon. These innovations definitely create an impact on their customers that can determine their satisfaction and loyalty. Further, Yadav & Dabhade (2013) purpoted that service providers frequently place high priority on customers' 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, investigate and quantify the magnitude of customers' satisfaction with the services, 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 and 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 telecom industry, customers satisfaction with the services, customers loyalty and the impact these services exhibit on satisfation and loyalty; the current study fills the literature gap by examining these in Cameroons mobile telecom industry with the view of finding out what consumers' perception of their customer relations 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; section 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 methodology 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. Section 5 presents empirical results and policy implications and lastly, section 6 draws conclusions.

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 aimed at addressing key macroeconomic and sectoral issues that were confronting the country. Accordingly, two basic elements of the programme included the deregulation of internal commerce aimed at lowering domestic cost structure, and the restructuring and rehabilitation of the public 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 this initiative in 1995. The process took the form of economic liberalisation with a view of 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, regulatory 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 new 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 telecom 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 telecom 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, 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 CMR and Orange CMR 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

Source: (Authors' Compilation, 2017), ITU World Telecommunication/ICT Indicators database.

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 from their phones which is very popular among young Cameroonians (CameroonWeb, 2017). MTN is perhaps the most important telecommunications network in Cameroon 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 per cent; its customer 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 customers. These and more are subject to investigation in the current study.

Literature Review

The quest for greater market share has become paramount in this era of stiff competition in the mobile telecommunication industry, and many players in the sector are obsessed with finding ways meet up with the immense demands. Consequently, firms in the market seek to secure more customers by offering highly competitive packages to utility maximizing consumers (Woo & Fock, 1999). Therefore, 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 customer 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 telecom firms' mainly for instant communication, therefore, quality of services rendered by firms can determine consistency of purchasing the product from a particular player in the market; a critical success factor for a firm that want to compete, survive and maximize payoff is therefore to deliver quality services than the rival firm can do (Paulrajan & Rajkumar, 2011).

A plethora of studies on service quality, service innovation, and their impact on customers' satisfaction, loyalty and retention have been carried out in various dimensions of the social sciences including health, education, banking, finance, telecommunication services, but much remains to be illuminated particularly in the mobile telecommunication sector that is increasingly embracing expeditious technological innovations at a time that consumers of their services are well informed about better alternatives in the market. Therefore, service quality is a vital ingredient of telecommunication services.

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 of service providers in terms of the superior performance promotional advertising, services delivery, good coverage and clear signaling, 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 customers' 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 postpaid 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 affect on customers' satisfaction. However, in this ever changing technological world with likely assortments of complements from competitors; either service quality is an antecedent of technological innovation or both are cuncurrent. 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 telecom 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 continue to be on an exponential increase. The increasingly global telecom landscape now poses a competitive challenge, but also provides a new way for business burgeoning. Addressing these challenges and opportunities requires the provision of quality service (IBM, 2010). Accordingly, technological innovation is seen as a fundamental factor that determines 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 impact on firms customers' satisfaction. Therefore, customers' satisfaction is another vital component of a firms survival that requires meticulous investigation particularly in the telecom industry in Cameroon that has recently undergone major technological innovations.

"Customers' satisfaction is a feeling of either pleasure or disapointment 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: overall 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 most 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. However, very few of these empirical studies have been carried out in Cameroon that relates service quality with customers' satisfaction, an indepth analysis of service quality in relation to customers' satisfaction in the telecom industry of Cameroon is therefore fundamental to contribute to the literature and in designing policies that can improve on customers experiences.

Theoretical Framework and Methodology

The theoretical framework of this study is rooted in the theory of utility maximisation by consumers which is very similar to those used in previous studies; a considerable 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). However, very few of these studies on customers' satisfaction in the telecom sector have applied the logit model (Khayyat & Heshmati, 2012; Anand & Bansal, 2016), as a great deal of them tend to employ Factor Analysis[FA], Multiple Regression Analysis[MRA] and Structural Equation Modelling[SEM] (Vranakis, et al., 2012; Almossawi, 2012; Huang & Kaewmee, 2011). There is substantial evidence in the literature which prove 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. Unlikc discriminant analysis, logistic regression makes no assumptions about the distributions of the explanatory variables. Consequently, the explanatory variables do not need to meet stringent requirements of normality, linearity and homoscedaticity. Unlike multiway frequency analysis, the predictors do not need to be discrete; the predictors can be any mix of continuous, discrete and dichotomous variables, Unlike multiple regression analysis, which also has distributional requirements 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 telecom firm can be described by a logit model which is expressed as a nonlinear function of explanatory variables as follows:

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

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. $\gamma^{-1}(P_i) = x'_{ij}\beta_k$ (Frees, 2004). Therefore, this transformation gives us a linear regression model of the form:

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

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:

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

(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;

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

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

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

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

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

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.

Research Setting and Data Collection

The data set used in this study 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 prior to administering the research instrument, participation was voluntary and personal information classified. A total of 520 questionaires were printed and distributed; 363 surveys were completed and returned, resulting in a response rate of 70 percent. Out of the 363 returned questiionaires, 63 were judged inappropriate for the analysis because of multiple problems which included missing data and inconsistency in the responses. Therefore, only 300 surveys were analysed implying an effective response rate of 58 percent.

The 40-item questionnaire inquired about customers' 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 were verified using the Cronbach's Alpha. Many researchers have argued as to what benchmark should be considered when verifying 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 especially with scales fewer than ten items. It may thus 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 cited 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

Source: Authors' Computations(2017)

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 retain 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 considerably, 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(1 if Agree, 0 if otherwise(Disagree). SPSSv21 and Stata12 softwares were used to run the analysis.

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 and finally, 58.3% of the respondents agreed that their expectations were being met while 41.7% reported that their expectations were not being met 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 requiring that the descriptive results should be subjected to meticulous analysis to illuminate the situation. 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

Source: Authors' Computations(2017), DV(Dependent Variable)

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 have 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 that the network has a good geographical coverage, 60% reported that the network transmission quality is good while 56.3% agreed that the voice quality of

MTNs network is good. Therefore, the findings portray that the network coverage and signal quality of the telecom firm is good.

Descriptive results on perceived value shows 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 in effect 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 cusltomer relationbship 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

Source: Authors' Computations(2017

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. $Y_i = 1$ increases, 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 remains 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 prefered telecommunication firm in Cameroon. Prior to upgrading to 4G LTE technology, drop rate of calls use to be very 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 greatly contributed to the satisfaction of customers with the services. The current results seems to corroborate previous research and theory (Paulrajan & Rajkumar, 2011). Generally, improvements in signal and network quality increases network satisfaction, service satisfaction and also makes customers to realise their expectations.

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 not be accurate. Sometimes, customers subscribe to temporary promotional packages which when they expire, the network provider does not remind them but automatically revert to a previous and more expensive tarrif plan rendering the customer unsatisfied, 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 is one main reason why customers have constantly been migrating from one SIM Card to another to get a better plan, benefit from discrimanatory promotional packages with newer SIM Cards while maintaining a permenent line for their constacts. 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. Therfore, attractive promotional packages are likely to stimulate customers satisfaction with the telecommunication services. Overaall, 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 contradict the generally established positive association between perceived value and customer satisfaction (Adilaka, Chalitaa, & Vinaia, 2016; Yadav & Dabhade, 2013)

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 mangement particularly in a private bussiness 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 actually 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 avaialable agents on standby for further technical difficulties. However, quite a good number of respondents reported that the agents hardly respond to their calls which may be a call for concern. Overall, customer service is a vital determinant of network satisfaction in Cameroons mobile telecommunication sector and also improves service satisfaction, make customers expectatiosn to be realised as shown by the odds ratios>1.

Service Innovation: Service quality is either an antecedent of technological innovation or both are cuncurrent. 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 comformity 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(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		Nagelkerke R^2=.632			Nagelkerke R^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		

Source: Authors' Computations(2017), OR<Odds Ratio>, PV<Probability Value, CI<Confidence Interval>

Effects of Service Quality on Customer Loyalty

New emphasis in mordern 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). Siganl 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 signficant determinants of customers 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 leading 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 that the study was carried out at a time that customers have frequently experienced internet cuts due to the anglophone crisis in Cameroon. Therfore, such intentions to leave the network if better alternatives were presented should not come as a surprise.

Service innovation is perhaps a better predictor of customer loyalty as 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 reduces 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

Variable	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		

Source: Authors' Computations(2017), OR<Odds Ratio>, PV<Probability Value, CI<Confidence Interval>

Conclusion and Policy Implications

Today the internet and the services it supports have palpable effects on almost every segment of our lives. It is based on the note that the current study aimed to investigate technological innovations, service quality and customer satisfaction in Cameroons mobile telecommunication industry. Our findings show that signal quality and network coverage, customer service and service innovation exhibit significant effects on customers' satisfaction and loyalty. Service innovation is the most important determinant of customers' loyalty. 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. Since acquiring new customers is considerably more expensive than retaining existing ones, telecommunications firms should drive more attention to improving customers' loyalty and satisfaction. This should be achieved when quality services, good customer relationship management is developed, innovations that met the needs of the alert consumers in a market with high competition are introduced. Service providers should also ensure to develop an accurate billing system that do not cheat on consumers, provide services at affordable charges and provide attractive promotional packages.

Perhaps, 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 North West and South West only exacerbate customers' satisfaction, making them prone to switching to a better, reliable and trust worthy alternative at the least opportunity. Therefore, a limitation of this study is that it did not include in its content customers trust, this should be addressed in future research. The sample size of the study was also considerably low considering the millions of subscribers; therefore, a larger sample will provide results that can easily be generalized.

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