

Confirmatory factor analysis of service quality dimensions within mobile telephony industry in Ghana

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Abstract: Due to the increasing importance and investment in modern information systems (IS) technologies, the evaluation of service quality (SQ) in information system environments has attracted significant attention and debate in the literature. Much effort has been made by scholars and practitioners to use IS service quality criteria and dimensions in different industry contexts. Not much attention has been devoted to using other SQ model criteria and dimensions to evaluate information systems in the mobile telephony industry (MTI) context. This study fills the gap, and contributes to the body of knowledge in the area SQ in the MTI environment.

This paper, which was a part of a larger study, sought to empirically validate SQ dimensions that are relevant to the mobile telephony industry in Ghana. It used Confirmatory Factor Analysis (CFA) to detect the underlying latent variables that significantly determine SQ in Ghana's MTI. 1000 customers were sampled from four mobile telecom operators in Ghana in a cross-sectional survey that used a self-administered structured questionnaire for data collection. The findings indicate that four emerged SQ dimensions relevant to Ghana's MTI were labelled as: Customer relations, Image, Tangibles and Real network quality. Cronbach alpha reliability for all items indicated a high value of 0.918. Service providers could conveniently use the derived instrument items for measuring service quality in Ghana Mobile Telephony industry. It concludes that aside the popular SERVQUAL, alternative SQ models model, like one conceptualised in this study, could be useful in determining SQ dimensions relevant to MTI. Limitations and directions for research are discussed.

Keywords: Service quality, SERVQUAL model, Technical and Functional Quality Model, mobile telephony industry, factor analysis.

1. Introduction

The need for business organisations to focus on improving service quality in order to remain competitive and influence customer behaviour has long been recognised in the literature (Grönroos 1990; 2001; Kotler & Keller 2006; Lovelock & Wirtz 2007). Service quality has been noted in many studies as a significant antecedent of customer satisfaction and customer loyalty (Parasuraman, Zeithaml, & Berry 1988; Rust and Oliver 1994; Spreng & Mackoy 1996; Voss, Rosenzweig, Blackmon & Chase 2004; Zeithaml & Bitner 2003). SQ evaluation from consumer's perspective was described by Grönroos (1982) as Consumer Perceived Quality (CPQ). CPQ has been differently conceptualised by many authors and has resulted in the proliferation of many models of service quality, each of which is context specific with unique features (Nitin Deshmukh & Vrat 2005). While existing literature on service quality for mobile telephony in emerging economies context is limited, those that exist are country specific. Therefore the purpose of this paper is to identify the latent variables for service quality dimensions most relevant to MTI in Ghana using factor analysis.

2. Literature Review and Conceptual Framework

2.1 The Mobile Telephony Research Context

Many previous studies suggest that further research is required to investigate whether the service quality dimensions proposed in service quality models apply to other different industry contexts (April & Pather 2008; Molla & Licker, 2001; Nitin *et al.* 2005; Newman & Cowling 1996; Parasuraman, *et al.* 1988). The mobile telephony industry like many service organisations has unique features that are relevant to customer requirements different from the traditional goods industries. Though MTI could be classified as an Information System (IS) environment for which IS-service quality models may be applicable, it is argued that, the industry is a unique wireless electronic environment with unique mobile services delivery from mobile network operators to individual consumer (B2C) and industrial customers (B2B). Such uniqueness may have relevant implications for what quality of network services consumers (B2C) expect from service providers and the relative worth of each service quality

dimension. The uniqueness of MTI, apart from its distinctiveness as a sector, lies in terms of the impact of the industry on consumer life. It appears that it is one industry among the information systems category that is ubiquitous, giving access to the use of mobile telecommunication services to the largest number of individuals in both developed and developing countries (ITU, 2010). Mobile telecommunication service in Ghana is not only becoming a necessity for business and social life, but also it is one of the information system services category that is easy to use and has been widely used by illiterates and literates everywhere in cities, rural and urban communities.

The deregulation of Ghana's mobile industry since 1994 has allowed new private mult-national entrants into Ghana MTI, which has contributed to the fierce competition among the service providers in the industry (Addy-Nayo 2001; Frempong & Henten 2004; Ghana NCA 2010). Delivering high SQ has, therefore, become a major concern for the mobile network operators in Ghana. The SQ of the industry may include dimensions different from other service contexts studied in the literature. Thus, customers may expect many different dimensions of the SQ relating to service quality expected to be delivered by mobile network operators. It would be a useful contribution to increase understanding of the constructs and dimensions of SQ relevant to the MTI in Ghana in the B2C context.

2.2 Service Quality Concept

The literature is filled with proliferation of different definitions for service quality from different perspectives. It is defined as the extent to which a service meets customers' needs or expectations (Asubonteng, McCleary, & Swan 1996). In Parasuraman et al. (1988), SQ is defined as a form of attitude, which could be related to satisfaction but not equivalent to it that results from a comparison of expectations with perceptions of performance. SQ as perceived by consumers is often termed consumer-perceived quality (CPQ). Grönroos in 1982 was the first to define the CPQ as the confirmation (or disconfirmation) of a consumer's expectations of service compared with the customer's perception of the service actually received. In the work of Edvardsson (2005:128), the author noted that "customer perception of service quality is beyond cognitive assessment as it is formed during the production, delivery and consumption of services and not just at the consumption stage." This is achieved as customers play their role as co-producers by carrying out activities as well as being part of interactions that influence both process quality and outcome quality. The concept of SQ from the customer perspective, therefore, includes not only *what* (outcome) the consumer expects, but also *how* the consumer is served (Grönroos 2001:151).

SQ is not just a corporate offering, but a competitive weapon which is necessary for corporate profitability and survival (Anderson, Fornell, and Lehmann 1994; Grönroos 1990; Newman & Cowling 1996; Rosen, Karwan, & Scribner 2003). Successful modern organisations no longer compete only on cost but more importantly on service/product quality. In a competitive environment like the MTI, delivering quality service is seen as a key differentiator and has increasingly become a key element of business strategy (Heskett, Sasser & Schlesinger, 1997; Kotler & Keller, 2006). Thus, in most service context, SQ is a critical business requirement (Voss, 2003, Voss *et al.* 2004) that is driven by employee satisfaction, which also drives customer satisfaction, which in turn drives customer loyalty and retention that eventually leads to profitability and growth, as proposed in the Service-Profit Chain (Heskett, Jones, Loveman, Sasser, Schlesinger 1994).

3. Service Quality in Information Systems Context

There have been several attempts by scholars to understand, evaluate and identify key factors that determine quality of information systems from the end-user perspective. As a result, some significant effort has been made by scholars and practitioners in the information systems literature on electronic service quality (E-service quality). E-service, according to Rowley (2006), refers to deeds, efforts, or performances whose delivery is mediated by information technology. Generally, it can be described as an interactive content-centered and internet-based customer service that is driven by customers and integrated with the support of technologies and systems offered by service providers, which aim at strengthening the customer-provider relationship (Cronin 2003; Zeithaml, Parasuraman, Malhotra 2000). Given the technology quality dimensions of e-service quality that are different from the traditional service context, e-service quality has been regarded having the potential to not only deliver strategic benefits but also to enhance operational efficiency and profitability.

A review of existing literature indicates that, results from many previous studies identified different dimensions for e-service quality in different research contexts (Li and Suomi 2009; Ho and Lin 2010). DeLone and McLean (1992) developed their first IS model and classified IS effectiveness measures into six categories. Later they revised it to include service quality in their Updated D&M IS success model (DeLone & McLean 2003). Dabholkar (1996) also found the following e-service quality aspects: site design, reliability, delivery, ease of use, enjoyment and control in the context of E-service. Zeithaml *et al* (2000) found these six critical dimension factors: Efficiency, reliability, fulfillment, privacy, responsiveness, compensation, and e-service quality dimensions in the online retailing context. Moreover, Zeithaml *et al.* (2000) proposed a 7-dimension instrument for measuring e-service quality called E-S-QUAL using the SERVQUAL in the traditional distribution channels in a study on internet service quality.

Zeithaml *et al.* (2002) again conducted a study in which they compared the SERVQUAL and the E-S-QUAL and concluded that though some traditional SERVQUAL dimensions can be applied to e-service quality, there are other unique dimensions of e-service quality that related to technology. The original E-S-QUAL consisted of 11 dimensions and later condensed into 7 by Parasuraman *et al.* (2005), which were split into core dimensions and the recovery dimensions. The core dimensions, termed E-S-QUAL, are: efficiency, system availability, fulfillment and privacy. The recovery dimensions, termed E-RecS-QUAL are: responsiveness, compensation and contact (Parasuraman *et al.* 2005). Yoo and Douthu (2001) also found that ease of use, aesthetic design, processing speed and security were important factors in online retailing.

Moreover, Wolfinbarger and Gilly (2003) found these four e-service quality aspects: web site appearance, communication, accessibility, credibility, understanding and availability as critical factors in online retailing. Lee and Lin (2005) developed e-service model including web site design, reliability, responsiveness, trust, and personalization in the online retailing context. Furthermore, Field, Heim & Sinha (2004) identified website design, reliability, security and customer service aspects of e-service dimensions. Kim *et al.* (2006) identified nine e-service quality items, being: efficiency, fulfillment, system availability, privacy, responsiveness, compensation, contact, information and graphic style in online retailing. More recently, in Li and Suomi (2009) eight dimensions of e-service quality were proposed, which were: website design, reliability, responsiveness, security, fulfillment, personalization, information and empathy. In empirical work of Cristobal (2007) and Ho and Lin (2010) the following service quality dimension were found in Internet banking context, these were: web design, customer service, assurance, preferential treatment and information provision. Pather & Usabuwera (2010) also identified and proposed seven items for e-service quality items, namely: reliability, security, appearance/aesthetics, availability/access, ease of use, responsiveness and communication.

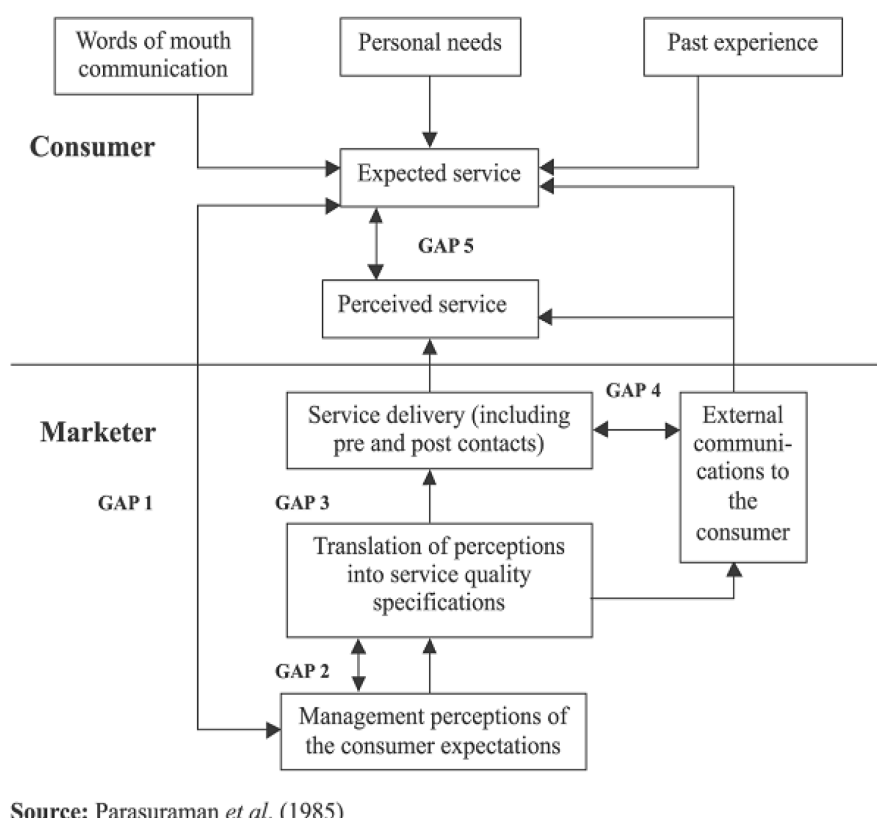
The above review shows that different dimensions have been found in different industry context in the IS literature, and that very little attention has been devoted to understanding IS service quality criteria and dimensions in mobile telephony context.

4. Evaluating Service Quality in IS Contexts

4.1 SERVQUAL-based IS Service Quality

Many studies have generally found useful the inclusion of service quality perspective to IS user satisfaction research, some such as Kim (1990), Watson *et al.* (1993) and Pitt *et al.* (1995) specifically recommend the SERVQUAL as a measure of IS success. Kettinger and Lee (1997) developed and empirically validated, using factor analysis methods, a condensed 13-item scale called IS-SERVQUAL based on the 22-item SERVQUAL instrument for the IS environment, to reflect IS specific issues such as software, hardware and computer technology. In this regard, DeLone and McLean (1992) after developing their first DeLone and McLean (D&M) IS success model for classifying the multitude of effectiveness measures into six categories, revised it to include service quality in their Updated D&M IS success model (DeLone & McLean 2003). Their conceptualisation of SQ was based on SERVQUAL model by Parasuraman *et al.* (1988).

The basis of the IS service quality model in many previous studies (e.g. DeLone & McLean 2003) was the SERVQUAL model that was originally proposed by Parasuraman, Zeithaml and Berry in 1985 and modified in 1988 in the Extended GAP model (Figure 1).



Source: Parasuraman *et al.* (1985)

Figure 1 The Extended Gap Model of Service Quality

In their model, the authors conceptualised service quality as a five dimensional construct, to develop the popularly known SERVQUAL instrument. The five SERVQUAL dimensions are: Tangibles, Empathy, Assurance, Reliable, and Responsiveness. Tangibles are the physical facilities, equipment, and appearance of personnel. Empathy refers to the caring, individualised attention the firm provides its customers. Assurance means knowledge and courtesy of employees and their ability to inspire trust and confidence. Reliability is the ability to perform the promised service dependably and accurately, and Responsiveness refers to willingness to help customers and provide prompt service. The items for each of the dimensions have been modified in many previous studies to suit a particular context as noted by Parasuraman *et al.* (1988:31) that the SERVQUAL instrument could be “*adapted or supplemented to fit the characteristics or specific research needs of a particular organisation*”.

However, other researchers such as van Dyke *et al.* (1997) have controverted the validity and usefulness of SERVQUAL in the IS environment. Again the use of the SERVQUAL model itself has received several criticisms from many authors (Asubonteng *et al.* 1996; Babakus and Boller 1992; Cronin & Taylor 1992) for different scores, its dimensionality, applicability and the lack of validity of the model, notably the dependence or independence of the five main variables.

Whereas in many IS contexts, the SERVQUAL model-based IS Service Quality criteria and dimensions have been used extensively in evaluating IS service quality (Kettinger and Lee 1997; Kang and Bradley 2002; Park and Kim 2005), little attention has been given to the use of other alternative models of service quality in evaluating IS quality in the mobile telephony context.

Alternative Service Quality Model for Mobile Telephony Industry

In the empirical work of Nitin, Deshmukh and Vrat (2005) on service quality models, the authors found nineteen models of service quality that have been postulated by different authors in different service contexts with different but equivalent dimensions. The earliest model the authors found was the Technical and Functional Quality Model of Christian Grönroos (1984). In his model, SQ is conceptualised as a three-dimension construct, namely: technical quality; functional quality; and image (see Figure 2). He believes that the customer evaluations of perceived performance of service against his/her perceived service quality result in a measure of service quality. He explains Technical Quality as the quality of what consumer actually receives as a result of his/her interaction with the service firm and is important to him/her and to his/her evaluation of the quality of service. Functional

quality is how he/she gets the technical outcome. This is important to him/her and to his/her views of service he/she has received. Image, which could be referred to as reputational quality, is very important to service firms and this can be expected to build up mainly by technical and functional quality of service including factors such as tradition, ideology, word of mouth, pricing and public relations. Although, this model has not been widely adopted and applied in many research contexts as compared to the SERVQUAL of Parasuraman *et al.* (1988), few authors like Bozorgi (2007) and Gi-Du and James (2004) who applied it recommended for different settings.

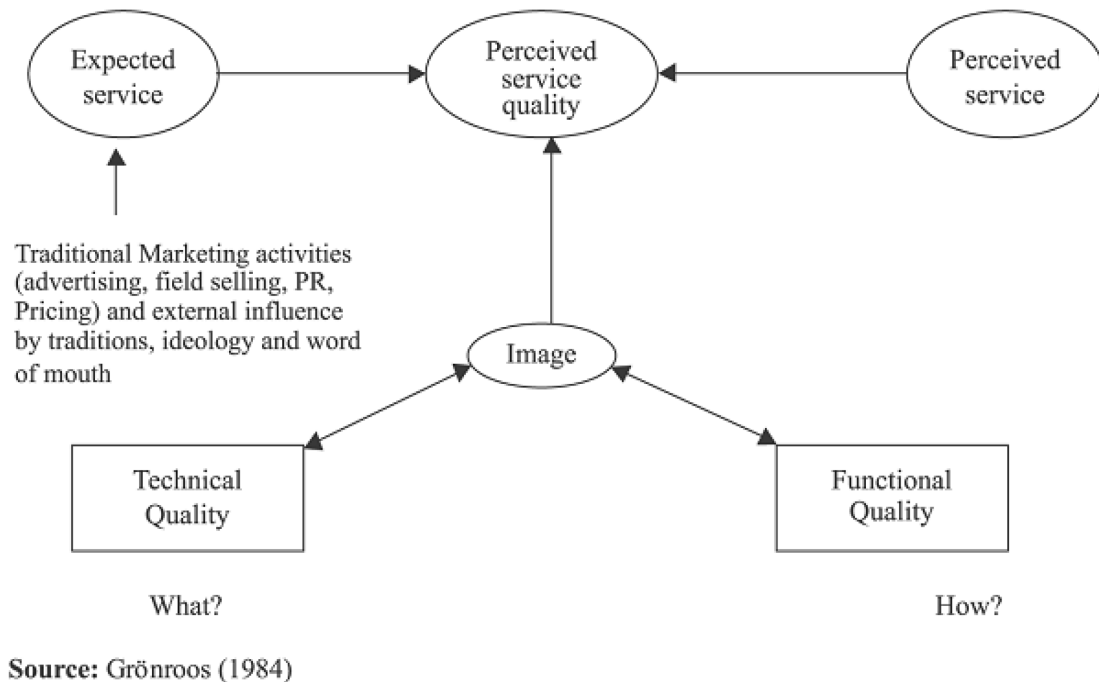


Figure 2 Grönroos Model of Service Quality

4.2 Justification for the Alternative SQ model

After reviewing many service quality models, Grönroos' (1984) model of service quality was selected in understanding service quality dimensions that may be relevant to the mobile telephony industry. The Model was deemed most appropriate for the study for three reasons. First it is comprehensive in that it includes not only functional quality as portrayed by Parasuraman *et al.* (1988) but also technical quality as well as image, which is more realistic of today's dynamic global marketplace than what functional-quality-only models portray. Gi-Du and James (2004: 266) applied the model in a similar mobile telecom setting and concluded that, "The results from a cell phone service sample revealed that Grönroos' model is a more appropriate representation of service quality than the American perspective (SERVQUAL model) with its limited concentration on the dimension of functional quality." Second, the model is more suitable for mobile telecommunication context. Nitin, et al (2005: 946) noted that "the service quality outcome and measurement is dependent on type of service, setting, situation, time need, etc. factors." The mobile telecom market is a type of service industry in which customers place much importance not only on how they are served (functional quality), but also and more importantly, on outcome or nature of services they receive and experience which constitute technical quality variables like network quality (Wang & Lo 2002; Gi-Du and James 2004). Third, the model is empirically validated by Gi-Du and James (2004) and has been applied by Bozorgi (2007) who recommends it for different mobile telecom context. The validated model is displayed in Figure 3.

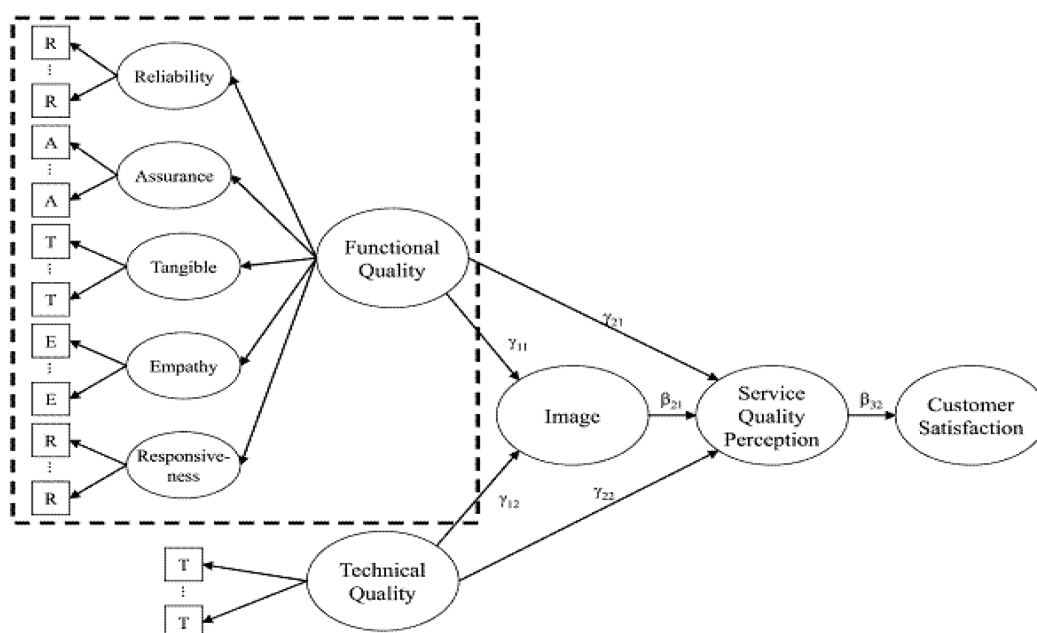


Figure 3 Grönroos Service Quality Model

Source: Grönroos (2000 cited in Gi Du & James 2004: 269).

For the above reasons, service quality is conceptualised to include all three dimensions of Grönroos' SERVQUAL model, namely: functional quality, technical quality and image or reputational quality.

Rust & Oliver (1994), and more recently also Hume & Mort (2008) contend that 'value' is a significant dimension of SQ that significantly affects customer satisfaction. Value is considered what the consumer gives in exchange for what he gets. "Value" could be described as the value for money or how economical services are to customers. Consequently, "value" will be termed "economy" dimension, and in this study, will be included separately as a fourth dimension of service quality. Therefore, the conceptual framework for this study has four dimensions of SQ, namely: Functional, Technical, Image and Economy SQ dimensions (Figure 4). A factor analysis approach is applied to determine the relevant dimensions in mobile telecom context.

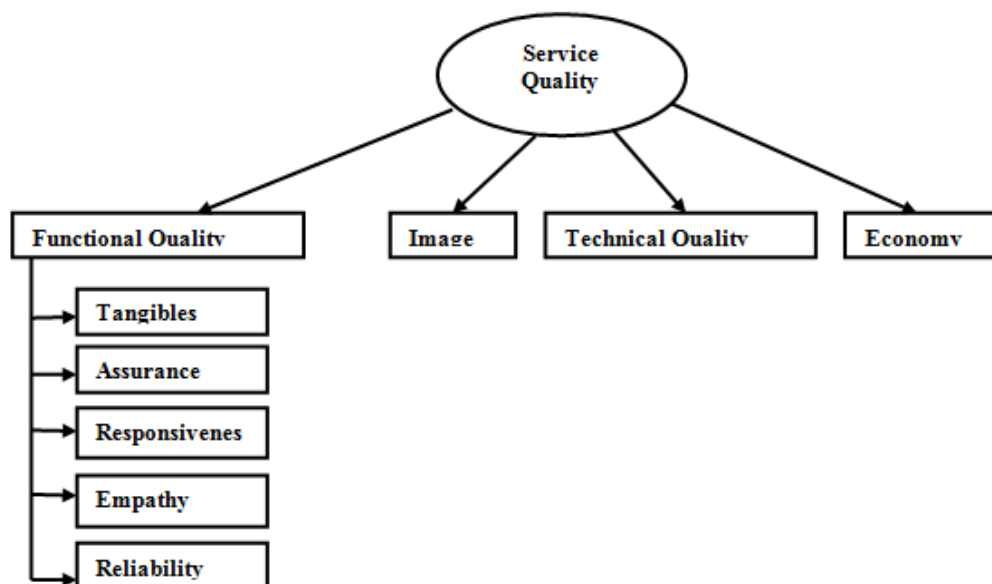


Figure 4: Emerged Framework

Source: Based on Grönroos (1984); Parasuraman, Zeithaml & Berry (1985); Hume & Mort (2008) and Rust & Oliver (1994)

5. Methodology

5.1 Sampling

In order to collect data of high quality that reflect customers' opinion, a survey was conducted from the four mobile telecom networks in Ghana in 2008; namely: Scancom Ghana Limited operators of MTN, Millicom Ghana Limited operators of Tigo, Ghana Telecom operators of Onetouch, and Kasapa telecom. For anonymity, each of the four companies used in this study is represented by a letter (A, B, C and D). A convenient sample size of 1000 respondents was selected from the four networks. Conscious effort was made to select literate respondents. The survey yielded a response rate of 93.7%, of which 601 customers were from Company A, 140 customers from Company B, 40 from Company C and 156 customers from Company D. These numbers were adequate since a minimum sample of 30 is considered a large sample size for statistical analysis (Cooper and Schindler, 2006). Research Instrument Design

A self-administered, structured questionnaire was used to collect data from respondents as recommended for a large survey (Saunders 2000; Cooper and Schindler 2006; Malhotra & Birks 2007). Based on the recommendations of Danaher and Haddrell (1996), Devlin, Dong & Brown (1993) and Rust & Oliver (1994) we appropriately adopted five-point disconfirmation scales to measure dimensions of perceived service quality since personal contact was to be used and high predictive validity was a major concern: The Likert scale ranged from much better expected to much worse than expected, coded 1-5 respectively. This present study was part of a larger study so the questionnaire had five 5 items related to respondents' identification data, and included eight dimensions of SQ with thirty-six items. The five Functional Quality items were basically based on constructs initially developed by Parasuraman *et al.* (1988), but modified for the research context. Thus Functional Quality is defined in terms of five main variables: tangibles, reliability, responsiveness, assurance and empathy. Technical quality and image constructs were developed by the researchers guided by similar previous studies, and specific indicators for each Functional Quality variable were based on previous research (Gi-Du and James 2004; Parasuraman *et al.* 1988; Wang & Lo 2002). The items were then modified within the context of the Ghana MTI settings. The main dimensions and their specific indicators are depicted in Table 1.

Table 1: SQ Dimensions and indicators

CODES	DIMENSION AND INDICATORS
	TANGIBLES
TA1	Network's ability to give you access to information, SIM card (chip), reload cards
TA2	Provision of visually attractive, offices, equipment and materials like starter packs and reload cards
TA3	Network's ability to providing variety of entertainment facilities, etc.
TA4	How appealing the appearance and uniforms of employees are.
	RELIABILITY
RL1	How timely is the delivery of SMS, MMS, Voice message and other services of network.
RL2	How mobile network is truthful (keeping to promises)
RL3	How dependable and consistent network i in solving customers' complaints
RL4	How able network is to perform services right the first time
RL5	How able is your network to insist on error-free records.
	RESPONSIVENESS
RS1	How network is able to tell customers exactly when services will be performed
RS2	How network is able to give prompt customer services and attend to customers' needs/problems
RS3	How employees' are willing to help customers in emergency situations
RS4	How the employees are approachable and easy to contact
RS5	Employees' ability to communicate clearly to customers.

	EMPATHY
EM1	Having convenient periods & terms for activation, recharge, and accounts suspension, free call times.
EM2	Having operating hours convenient to all customers.
EM3	Having sound loyalty programme to recognise you as a frequent customer.
EM4	Having the customer's best interest at heart.
EM5	Giving individual customer attention by employees.
EM6	Efforts to understand specific customer needs.
EM7	Apologising for inconvenience caused to customers.
	ASSURANCE
AS1	Ability to provide variety of value added services- Music, internet access, SMS,etc.
AS2	Sincerity and patience in resolving customers' complaints/problems.
AS3	The behaviour of employees in instilling confidence in customers.
AS4	Employees' use of required skills and knowledge to answer customers' questions.
	ECONOMY
EC1	How economical the use of mobile telecom network's is services in terms of: Reloading cards and their denominations
EC2	How economical the use of mobile telecom network's services is in terms of: The call charge per minute/second
	TECHNICAL QUALITY
TQ1	Successful in completion of calls, SMS, MMS, line activation, credit reloading, etc
TQ2	Employees have technological knowledge and skills in solving customer problems.
TQ3	Network clarity and speed for call and other services.
TQ4	Network innovativeness – ability to use current technology to improve services.

Source: Developed based on Based on Grönroos (1984); Parasuraman, Zeithaml & Berry (1985); Hume & Mort (2008) and Rust & Oliver (1994).

The questionnaire was pre-tested to a sample of twenty (20) subscribers purposively selected. This small size was guided by the suggestion by Fink (2003b in Saunders, Lewis, Thornhill 2007) that the minimum of ten (10) members for pre-testing is adequate. Finally, adjustments were made to get more effective instruments, the initial reliability test for the dimension items yielded a Cronbach alpha from 0.68 to 0.86 (Table 2). The questionnaire was administered to the target population through personal contact by research assistants for nearly two weeks. To improve representativeness, it was administered in three selected cities in three zonal divisions in Ghana, namely: Tamale for the Upper Zone, Kumasi for the Middle Zone and Accra for Southern Zone.

Table 2: Reliability test showing Cronbach alpha from 0.68 to 0.86

Multi-Item Scale (Dimensions)	Cronbach Alpha	Number of items
Tangibles	0.715	4
Reliability	0.780	5
Responsiveness	0.830	5
Empathy	0.850	7
Assurance	0.800	4
Economy	0.680	2
Technical quality	0.820	5
Image	0.838	4
All items for 8 dimensions	0.860	36
Table 2 Scale Reliability Source: Field data, SPSS output		

6. Data Analysis

Demographics, factor analysis and item/scale reliability were analyzed using SPSS version 16.0 for Windows.

6.1 Demographic Data

The characteristics of the respondents are presented in Table 3. In terms of gender, 55% of the respondents were males and 45% were females. 50% of the respondents were within the ages of 20-39 years and 13% were between 40 and 49 years, implying that majority of them were in the economically active population.

Occupation-wise, most of them (63%) were students, 24% were public servants, 4 % were business persons, while 9% belong to other professions. In terms of income, 98% of respondents earned monthly income below GH¢300 of which 31% earned between GH¢100 to ¢200 while 30% earned virtually no monthly income indicating that most of them earned considerably lower incomes. All respondents were educated with 75% of them having tertiary education, while 25% had Senior High School (SHS) and post-SHS education levels.

Table 3 Respondents' characteristics (n = 937)

		Frequency	%	$\bar{x}$	Std Dev
Gender	Male	520	55.5		
	female	417	45.5		
Occupation	Civil/Public	222	23.7		
	Student	592	63.2		
	Business Person	35	3.7		
	Other	88	9.4		
Age	<20	16	1.7		
	20-29	470	50.2		
	30-39	316	33.7	31	0.8
	40-49	121	12.9		
	≥ 50	14	1.5		
Income	<100	93	9.9		
	101-200	277	29.6		
	201-300	195	20.8	130.8	1.4
	>300	79	8.4		
	Non-income Eamer	293	31.3		
Education Level	SHS	74	7.9		
	Post SHS	162	17.3		
	Tertiary	701	74.8		

Source: Field data, 2008

6.2 Factor Analysis

Factor Analysis (FA) is a data reduction technique that uses correlations between data variables. It assumes that some underlying factors exist that explains the correlations or inter-relationships among observed variables (Chatfield and Collins 1992). It has been used extensively in psychology, econometrics, marketing, sociology, and education (Bollen 1989; Doll, Xia, Torkzadeh 1994; Li, Tan, and Xie 2002). Statistical data analysis for this study for FA followed the approach similar to the one used by Kettinger and Lee (1995) and April and Pather (2008). Basically the steps involved are:

1. Exploratory factor analysis
2. Regrouping of items
3. Confirmatory factor analysis
4. Testing the validity and reliability of the emerged dimensions

6.2.1 Exploratory factor analysis (EFA)

EFA is fundamentally used to reduce large number of variables down to a smaller number of components. It is a method that aims at extracting maximum variance from the dataset within each factor (Chatfield and Collins 1992). In the empirical work of Costello and Osborne (2005) on best practices in exploratory factor analysis, they strongly recommended the use of Principal Component Analysis (PCA) since it has the potency of revealing the underlying structure of the latent variables with an appropriate rotation method. On rotation methods they advice that "In general, ML(Maximum Likelihood) or PAF (Principal Axis Factoring) will give you the best results, depending on whether your data are generally normally-distributed or significantly non-normal, respectively (2005: 2). They further recommend preference for the use of Oblique rotation over Orthogonal since the former "will reproduce Orthogonal solution but not vice versa" (2005: 7). Therefore, for the present study since the sample was large and the items were generally normally distributed ($0.952 \leq SD \leq 1.20$), ML extraction method with Oblique or Oblimin Rotation Method was chosen for EFA. This was performed on all eight dimensions with thirty-six items. For simplicity of analytical purpose each statement of the questionnaire was coded as TA1, TA2, RL1, RL2 and so on (see Table 1). On the criteria for selecting factor loading, generally factor loading above 0.6 is considered high while factor loading greater than or equal to 0.3 is considered moderately high (Klien 2005). Therefore the cut-off for analysing factor loading was 0.50 ± 0.03 . Next no items (row) should have multiple factor loadings greater or equal to 0.50 ± 0.03 . Lastly, no factors (columns) should have only one high loading item. Other factor loadings that do not satisfy the above criteria are considered meaningless and can be safely removed, while the high loading factors are critical factors and therefore can be retained.

The results of the EFA show a high value of 0.966 for the Kaiser-Meyer-Olkin Measure and indicate the suitability of the research data for structure detection, i.e. the proportion of variance in the items that might be caused by underlying factors. Thus, generally the data is useful for factor analysis. This is confirmed by the significance of the Bartlett's test of sphericity tests (X^2 : 15881.357, df: 630.000, Sig.: 0.000) indicating that the variables are not unrelated and therefore suitable for structure detection. Table 4 indicates that five factors or components emerged but the fifth factor had no significantly high loading items. Therefore, the fifth factor was eliminated together with fifteen items because they did not satisfy the criteria set for factor loading selection; these are indicated with strike-throughs. Only three dimensions of SQ were not affected at all (Tangibles, Economy and Image) while the other five dimensions were affected.

Table 4 Exploratory Factor Analysis

Pattern Matrix											
Item Loading	Factor					Item loading	Factor				
	1	2	3	4	5		1	2	3	4	5
TA1	-.069	-.078	.602*	.006	-.070	EM5	.662*	-.078	-.019	-.009	-.116
TA2	.023	-.017	.795*	-.104	.021	EM6	.581*	-.092	.004	.049	-.133
TA3	.061	.027	.503*	.103	-.013	EM7	.565*	.037	.059	.083	-.064
TA4	.051	.008	.531*	-.053	.004	AS1	.336	-.038	.262	.170	-.171
RL1	-.042	-.105	.350	.136	-.270	AS2	.693*	-.007	.040	.093	.055
RL2	-.114	-.017	.229	.158	-.362	AS3	.714*	.029	.028	.146	.161
RL3	-.311	-.060	.104	.040	-.333	AS4	.588*	-.092	.058	.138	.131
RL4	-.125	-.089	.216	.079	-.341	EC1	.116	-.094	-.014	.489*	.021
RL5	-.064	-.045	.189	.194	-.352	EC2	.067	-.016	-.052	.538*	-.104
RS1	-.147	-.085	.157	.118	-.396	TQ1	-.007	-.177	.197	.476*	-.011
RS2	-.331	-.109	.087	-.003	-.429	TQ2	.356	-.122	.116	.275	-.028
RS3	.610*	-.109	.035	-.114	-.176	TQ3	-.007	-.118	.049	.572*	-.128
RS4	.699*	-.008	.051	-.110	-.102	TQ4	.075	-.228	.128	.466	-.077
RS5	.710*	-.042	.033	-.137	-.026	TQ5	-.042	-.286	.065	.381	-.007
EM1	-.289	-.097	.159	.192	-.006	IM1	-.007	-.690*	.087	.042	.036
EM2	-.302	-.059	.055	.239	-.141	IM2	.007	-.900*	-.052	-.061	.004
EM3	-.325	-.002	-.028	.241	-.188	IM3	.035	-.771*	-.015	-.026	-.001
EM4	-.402	-.017	-.026	.239	-.237	IM4	.020	-.535*	.021	.162	-.039

Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization. *Retained factor loadings

6.2.2 Regrouping of Items

As shown in Table 5, Components 2 and 3 have only Image and Tangibles items respectively. While component/factor 1 contains a mixture of 3 items each from Responsible, Empathy and Assurance, component 4 contains a blend of 2 items each from Economy and Technical quality items, all of which are found in the original set of eight SQ dimensions in the conceptual framework for the study. These derived dimensions were then relabelled. The labels were intuitively chosen based on the meaning suggested within the context of mobile telephony industry. These are consistent with labelling and coding textual data (See Strauss & Corbin 1998; Wilkin & Castleman 2003). The justifications for these labels are as shown in Table 5:

Table 5: Regrouping of questionnaire items

Emerged Component/Factor	Retained Items	Labels for Component Dimensions
1	RS3, RS4, RS5, EM5, EM6, EM7, ASS2, AS3 and AS4	Customer relations
2	IM1, IM2, IM3, and IM4	Image
3	TA1, TA2, TA3 and TA4	Tangibles
4	EC1, EC2, TQ1 and TQ2	Real Network quality

Factor 1 is a good combination of Responsiveness, Empathy and Assurance items. Responsiveness items are: How employees' are willing to help customers in emergency situations (RS3), how employees are approachable and easy to contact (R4), and employees' ability to communicate clearly with customers (R5). Empathy items are: Giving individual customer attention by employees (EM5). Efforts to understand specific customer needs (EM6) and Apologising for inconvenience caused to customers (EM7). Assurance items are: Sincerity and patience in resolving customers'

complaints/problems (AS2), the behaviour of employees in instilling confidence in customers (AS3), and Employees' use of required skills and knowledge to answer customers' questions (AS4). These items basically relate to a firm's interactions with customers, and suggest the quality of informed and empathic responses of the service provider to customers that communicates the firm's concern, readiness, sensitivity and ability to satisfactorily address concerns, and meet the needs and requirements of customers. These items focus on the customers' perception of the service provider's knowledge and behaviour towards handling customers' need and complaints, based upon which service provider's sincere and appropriate responses are effectively communicated to customers in such a manner that lead to winning customers' confidence and loyalty. Therefore, the appropriate label for this component was Customer relations of service quality aspects of the service provider towards its customers.

Factor 2 contained only items from the original Tangibles dimension. None of the original Tangibles items was eliminated, so it could be retained as Tangibles dimension. This refers to the visible appearances of all representations of the service provider to the outside world seen in such things as employees' uniforms, firm support materials, and appealing nature of buildings and office environment.

Factor 3 had only items from the original Image dimension. None of the Image items was removed, so it was retained as Image or reputational quality. They include SQ aspects of being a successful firm, socially responsible, having good reputation and brand name.

Factor 4 had a mixture of Economy and Technical quality items. The two Economy items basically relate to how affordable the services are in terms of various recharging rates (EC1) and the call charge per minute/second (EC2). The Technical quality items are: Successful in completion of calls, SMS, MMS, and line activation, credit reloading (TQ1), and network clarity and speed for call and other services (TQ3).

These items represent the real value customers get for their money in patronising the services of the firms. It shows the ability of the service provider to deliver excellence services, at considerably affordable prices to different customer groups. In mobile telephony context, it could specifically entail providing high network quality that enables clarity and speed for call completion and all network services to the customers. Customers expect to get maximum value in the sense of Technical quality (outcome of the service usage) for every sacrifice they make towards the firm in the form of money, time, efforts, and so on. An appropriate dimension label for these items was Real Network quality, reflecting the ability of the service provider to provide quality network services at affordable rates to give customers greater value for their money.

6.2.3 Confirmatory factor analysis (CFA) on the remaining 21 items

The next step in the data analysis was to perform a CFA on the remaining 21 items using Maximum Likelihood extraction method with Oblimin rotation to confirm the dimensionality of the derived instrument. The CFA was run based on the procedure explained above. The results are presented in Table 5. With factor loading values above 0.4, three dimensions items - TA3, TA4, TQ1, and TQ2 - could be considered as moderately high. With factor loading equal to and above 0.5, three dimensions, TA1, AS4 and IM4, could be described as high. Finally, 15 dimension items are considered strong with values above 0.6 (Garson 2007; Kline 2005). Thus, the results of the CFA provide strong evidence to confirm the derived dimensions of the EFA in Table 4.

6.2.4 Validity and reliability of derived instrument

Instrument validity refers to whether the statistical instrument measure what it is intended to measure, i.e. accuracy of measurement of content (Saunders 2000; Straub, Boudreau & Gefen 2004) *Content validity* or sampling validity refers to whether a measurement instrument has adequate and representative coverage of the concepts in the variables being measured (Straub *et al.* 2004). It is usually achieved by seeking opinion of other investigators or experts. *Construct validity* has to do with measuring an instrument to an overall theoretical framework in order to determine whether the device confirms a series of hypothesis derived from an existing theoretical framework. In this work, the questionnaire items for this study were based on literature reviews and experts' review to ensure its content and construct validity. The survey instrument items were grounded in Grönroos' (1984) framework for SQ and other similar validated SERVQUAL instruments applicable to mobile industry (Gi-Du & James, 2004).

Straub *et al.* (2004) maintain that the two main aspects of *Construct Validity*, being, *convergent Validity* and *discriminant validity*, can be deduced from the CFA results. Since the items converge strongly to the derived dimensions, good convergent validity is indicated in the “strong” factor loadings. Also discriminant validity can be deduced because the factor loadings indicate that the items do not overlap across different dimensions.

Reliability refers to whether a measurement instrument is able to yield consistent results each time it is applied. It is the property of a measurement device that causes it to yield similar outcome for similar inputs. Statistically, a Cronbach alpha measurement can be used to determine reliability of a measurement instrument (Straub *et al.* 2004). A Cronbach alpha value of 0.7 and greater is considered reliable (Straub *et al.* 2004). The Cronbach alpha values from the SPSS output (see Table 6) for each component are greater than 0.7, and the composite alpha for all twenty-one items is 0.918, thus indicating good reliability.

Table 5: Confirmatory Factor Analysis for Derived Dimensions

Item		Factor			Item		Factor			
	1	2	3	4		1	2	3	4	
TA1	-.047	-.073	.588	.054	AS2	.701	-.027	-.025	.061	
TA2	-.026	.021	.866	-.062		AS3	.659	.018	-.038	.142
TA3	.072	.006	.476	.098		AS4	.563	-.119	-.012	.095
TA4	.079	.014	.481	-.027		EC1	.049	-.041	-.014	.620
RS3	.689	-.038	.067	-.063	EC2	.029	.056	-.002	.680	
RS4	.767	.061	.049	-.057		TQ1	.003	-.173	.188	.480
RS5	.772	.013	-.010	-.103		TQ3	.070	-.142	.078	.481
EM5	.718	-.036	.016	-.006		IM1	.005	-.676	.095	.025
EM6	.643	-.053	.020	.073	IM2	.026	-.910	-.058	-.077	
EM7	.603	.022	.025	.072		IM3	.022	-.748	.005	.011
						IM4	.025	-.520	.044	.166

Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization.

Table 6: Reliability Statistics

Emergred SQ Dimensions	Number of Items	Cronbach Alpha
Customer relations	9	0.899
Image	4	0.838
Tangibles	4	0.715
Real Network quality	4	0.759
All Dimensions	21	0.918

7. Discussion and Implementation

The results of the study show that out of the eight SQ dimensions with *thirty-six* instrument items developed from the literature, only *five* of the eight SQ dimensions are relevant in the context of mobile telephony industry in Ghana. There are *twenty-one* instrument items in the *five* derived

dimensions. Tangibles, Image and Economy SQ dimensions in the original SQ dimensions found in literature were retained, while the rest received considerable modification through the FA and subsequently labelled appropriately. The meaning and implications of derived dimensions are discussed as follows:

Customer relations: This label describes the blend of responsiveness, assurance and empathy which are all functional quality items that relate specifically to how customers' needs and concerns are handled effectively by employees based on each customer's unique needs and complaints, personality and demographic characteristics. Thus, *customer relations* include all staff-customer interactions of service quality aspects of the service provider towards its customers. This is very significant in the MTI since customers will want to contact their service operators often for many issues regarding their needs and complaints about mobile network services. These findings are consistent with the work of April and Pather (2008) who found that Responsiveness, Assurance and Empathy are collectively a significant component of Information Systems service quality criteria and dimensions that are applicable not only in large brick-and-mortar organisations, but also to SME e-Commerce businesses in the tourism sector in South Africa. They, however, labelled this component appropriately in their model as *Supportiveness* for their research context.

Many previous studies such as (Edvardson 2005; Lovelock & Witz 2007) have similarly discussed customer relation factors as the core of delivering effective customer services that highlights how customers would want to be handled and treated by the staff of service providers. Customer service was found to be an important e-service quality factor in the work of Cristobal (2007). Without effective customer relations the service providers are likely to find it difficult in attracting new customers, retaining existing customers and establishing effective long-term mutually beneficial relationship with customers (Edvardson 2005; Lovelock & Witz 2007).

The implication of this dimension is that marketing management need to focus on establishing and improving customer relationship management in the organisation. In this regard, the management of mobile telecom networks should ensure that their employees seek to influence customers positively through quality staff-customer interactions. It means that service providers in the MTI should establish effective customer service centres to manage all customer touch points, staff-customer interactions, handle customer complaints, and establish good rapport with customer while being sensitive to customers' changing requirements (Kotler & Keller 2006; Lovelock & Wirtz 2007).

Some of the key factors identified in the literature that fosters effective interaction between staff of service providers and customers are trust and reliability, effective communication and friendliness (Bansal, Irving, & Taylor 2004; Pather & Usabuwera 2010). In view of this, service providers should endeavour to use varieties of means to communicate to consumers effectively regarding new rates for calls, apologies for delay services and technical problems in network connectivity, new promotions and new products. Employees should pay attention to customer complaints and demonstrate expert knowledge in handling customer problems in order to build trust, assurance and reliability perceptions in customers. Again, staff should endeavour to develop, establish and maintain socially beneficial, friendly relationship with customers in order to elicit customers' positive feelings towards the service provider as a way of establishing affective loyalty bonds between the organization and its customers (Bansal *et al.* 2004).

Tangibles: This label concerns the visible appearances of all representations of the service provider to the outside world seen in such things as employees' uniforms, firm support materials, and appealing nature of buildings and other physical facilities. The attractive nature company's representations may have considerable influence in inviting existing customers to approach the service provider's customer service centres, and more importantly in eliciting positive perceptions of the service provider in the minds of potential customers. This dimension was similarly retained in the work of April and Pather (2008).

Previous studies have found that the quality of the firm's representations could influence customer satisfaction and behaviour intentions (Keaveney 1995). Customers are more likely to be identified with a service provider who they think has good and appealing nature of buildings, employees' uniforms, materials and vehicles, and other physical facilities.

The implication of this dimension is that managers should focus on improving and developing good and appealing physical facilities to improve customer perception of the firm, its staff and physical facilities. Managers should not only be concerned with the delivery of expert services but also they should seek to improve upon customer perception of their physical facilities and representation that appear to the general public. As customers patronize firms' offerings, they are not only interested in their problems being solved, but also they would want to feel proud of their companies for having good and appealing physical facilities and representation. Intuitively, this could not only have an indirect positive impact on customer loyalty but also on attraction of new customers through positive word-of-mouth communication from customers to their social and business groups, which in turn could attract more new customers.

Image or reputational quality: This dimension involves issues such as having good reputation, good brand name, and being socially responsible and well-known as a successful company in the minds of the customer and the public. Image or reputation quality has been found in previous studies to be one of the factors that could influence word-of-mouth communications, consumer perceived quality of service provider, consumer satisfaction, and eventually customers' loyalty to service provider (Kotler & Keller 2006; Lovelock & Wirtz 2007). Where customers have favourable image or good reputation of a service provider, they are more likely to have favourable service quality perceptions, high expectations for satisfaction and strong eagerness to recommend the service provider to family, friends and business partners.

The implication is that marketing management need to focus on creating favourable image of the service provider through effective promotional activities and the delivery of functional and technical quality (Grönroos, 1994). Service providers should, therefore, demonstrate the ability to deliver and exceed customer expectations not only with *how* they deliver the services (functional quality), but also and more importantly with *what* is delivered (technical quality). These two quality categories are able to influence customers' image of the service provider (Grönroos, 2001). Aside this, the management of the mobile telecom networks should focus on building good reputational quality through effective implementation of corporate social responsibility, and show their compliance with industry code of ethics. Service providers, in particular the mobile operators in Ghana, must avoid unethical corporate behaviour and scandals as it may have repercussions on their reputational quality, which in turn could influence consumers' intention to switch to other service providers (Keaveney 1995).

Real Network quality: This emerged SQ dimension fundamentally refers to ensuring Technical quality at affordable prices. Network quality represents fundamentally core service as far as mobile telecommunication is concerned. And consumers expect to experience this quality factor at a value equal to what they sacrifice for it. Thus, customers expect to have success in completion of calls, SMS, MMS, and line activation, credit reloading and network clarity and speed for call completion and other services, while expecting that the services received offer them real value for their sacrifices in money paid and time spent for the services. The difference between what consumers spent on the network services and the quality of the services they received should be equivalent, otherwise, customer value decreases.

The implication is that mobile network providers should focus on providing excellent network quality at affordable prices. This could in turn influence positively customer perceived value as customers perceive the benefit derived from the services to be greater than the cost of sacrifice (e.g. money) they lose in exchange for the services. Real network quality should be significantly evidenced in all core mobile telecom services and at affordable prices in terms of recharging rates, the call charge per minute/second, reconnection rates, number portability fees, among others. Where this quality is poorly delivered to consumers it could result in influencing their commitment to the service provider (Bansal et al. 2005), induce intention to switch and negative word-of-mouth (Gerrard, & Cunningham 2004; Keaveney 1995).

Finally, the study implies that the emerged dimensions could serve as useful criteria and dimensions for evaluating service quality in mobile telephony industry context.

The items in the emerged dimensions are summarised in Figure 2 and Table 7.

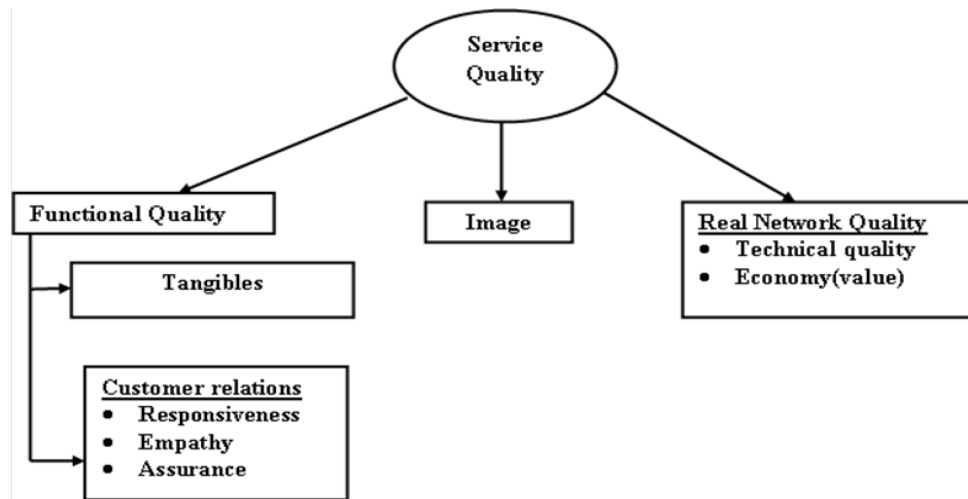


Figure 2: Derived SQ dimensions for MTI Context

Table 7: Derived Dimensions of SQ for Mobile Telephony Context

	TANGIBLES	
TA1	Network's ability to give you access to information, SIM card (chip), reload cards	
TA2	Provision of visually attractive, offices, equipment and materials like starter packs and reload cards	
TA3	Network's ability to providing variety of entertainment facilities, etc.	
TA4	How appealing are the appearance and uniforms of employees?	
	CUSTOMER RELATIONS	
RS3	How the employees are willing to help customers in emergency situations	
RS4	How the employees are approachable and easy to contact.	
RS5	Employees' ability to communicate clearly with you.	
EM4	Service provider having the customer's best interest at heart.	
EM5	Service provider giving individual customer attention by employees.	
EM6	Service provider's efforts to understand specific customer needs.	
EM7	Service provider's apology for inconvenience caused to customers.	
AS2	Employees' sincerity and patience in resolving customers' complaints/problems.	
AS3	The behaviour of employees in instilling confidence in customers.	
AS4	Employees' use of required skills and knowledge to answer customers' questions.	
	ECONOMY (VALUE)	
EC1	How economical the use of mobile telecom network's services is in terms of rates for reloading cards and their denominations.	
EC2	How economical the use of mobile telecom network's services is in terms of rates for the call charge per minute/second.	
	TECHNICAL QUALITY	
TQ1	Successful in completion of calls, SMS, MMS, line activation, credit reloading, etc	
TQ3	Network clarity and speed for call and other services.	

	IMAGE	
IM1	How <i>successful</i> mobile network company is	
IM2	The <i>reputation</i> of your mobile network service provider	
IM3	The <i>brand image</i> of the services.	
IM4	How service provider is <i>socially responsible</i>	

8. Conclusion

In many IS contexts, the IS Service Quality criteria and dimensions that have been used extensively in evaluating IS service quality are based on SERVQUAL developed by Parasuraman *et al.* (1985), little attention has been given to the use of other alternative models of SQ in evaluating IS service quality in the mobile telephony context. This paper attempts to fill this gap by drawing on Technical and Functional quality model (Grönroos 1984, 2000), through CFA approach, to propose a framework of latent factors that are critical for understanding SQ in IS evaluation in mobile telephony context. It contributes to the extant literature on information systems evaluation and advances our knowledge of critical factors that describe and reflect end-user evaluation of IS service quality specifically in the mobile telecommunication industry in developing country context. It also provides practitioners with a general framework as a guide for developing marketing and management strategies for effective management of IS service quality in mobile telecommunication contexts.

The four emerged dimensions with twenty-one items, being Customer relations, Tangibles, Image and Real Network Quality could be used by mobile network operators as critical factors in evaluating SQ in MTI. This, however, doesn't mean all the other five underlying dimensions in Reliability that were eliminated and the other fifteen items of Empathy and Assurance, Responsiveness and Technical quality are not important for Ghanaian customers. This instead indicates that it is necessary to modify the items to capture these 15 dimensions for service quality scale in Ghana mobile telephony industry. It concludes that alternative SQ models aside the popular SERVQUAL model, like one conceptualised in this study, could be useful in determining SQ dimensions relevant to MTI.

It is cautioned that the results of the present study should be interpreted within in the context of Ghana mobile telephony industry, and similar studies should be done in similar context in different countries to compare the results before generalisations could be made. The factors identified in this work for evaluating SQ dimension applicable to MTI are not exhaustive; they do not include factors such as security and ease of use which have been recently suggested in the work of Pather & Usabuwera (2010) to be important in end-user evaluation of information systems contexts. Future research should explore these and other critical factors in B2B industry context for a better understanding of service quality dimension relevant to both B2C and B2B telecommunication contexts in IS discipline.

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