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Viewing Systems as Services: The Role of Service Quality

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Abstract

The significant and sustained growth in services worldwide prompts IS researchers to give special attention to service and service concepts as core aspects of the IS field. This study proposes that 'viewing systems as services' is critical to extend the focus of technology-business alignment in service science research. The study evaluates the influence of mHealth service quality on satisfaction, perceived value and continuance intentions using an interdisciplinary approach. The conceptual model is rooted in the traditional cognition - affective– conation chain but explicitly identifies system quality, interaction quality and information quality as the core dimensions of mHealth service quality. The model is validated in the context of a business-to-consumer (B2C) mHealth service systems using PLS path modeling. The results confirm that service quality has a direct impact on continuance intentions and an indirect impact through perceived value and satisfaction in mHealth service systems.

Keywords: Service quality, perceived value, satisfaction, continuance intentions.

Introduction

The global economy is becoming characterized by services with more than 70% contribution in GDP from the service sector (Ostrom et al. 2010). This shift to service as a driver of economic growth is caused by the predominant presence of services industries. This global phenomenon of significant and sustained service growth is projected to continue unabated for both developed and developing countries. In this growth, IT organizations increasingly find themselves in a world of service systems to build business models, accelerate adoptions of new service platforms, deliver value and drive innovation. As such, 'viewing a system as a service' can help IT organizations align its interests with the services economy by improving service quality, capturing the business value of IT, and above all, enhancing satisfaction and continuance intentions (Maglio et al. 2009; Alter 2010). This service orientation requires firms to embrace service quality in order to perform better both at front stage and back stage (Sousa & Voss 2006; Akter et al. 2010). Indeed, for better performance, IT organizations increasingly emphasize on quality to address the challenge: "how can the voice of the customer and voice of the process be matched for the best overall performance?" (ifm & IBM 2008, P. 5). Despite the importance of quality in service systems, there is a paucity of research that explores the antecedents to and consequence of service quality in this domain (Jen et al. 2008). Indeed, service oriented thinking and quality dominant decision making are only beginning and a few preliminary guidelines for these links have been proposed. Therefore, Alter (2010) states that, "Viewing systems as services (and other aspects of the work system approach) should be used to explore and possibly reinterpret many of the results from prior research on the business value of IT".

'Service' is defined as the application of specialized competences, through deeds, processes, and performances for the benefit of another entity or the entity itself (Vargo & Lusch 2008, p. 26), whereas 'service system' is defined as a value co-creating process using resources include people, technology, organization and shared information in order to satisfy customer needs better than competing alternatives (ifm & IBM 2008, p. 5). Service system is also defined as a dynamic configuration of resources that co-creates value through interaction with its stakeholders (Spohrer et al. 2007). Viewing a system as a service necessitates focusing on 'customers first' because changes in customers' needs lead to the desired changes in service quality, which, in turn influences perceived value, satisfaction and continuance intentions (Alter 2010). This study focuses on mHealth, which is a transformative service system in healthcare for shifting the care paradigm from crisis intervention to promoting wellness, prevention, and self-management (Kaplan & Litewka 2008). 'mHealth' is defined as the application of mobile communications—such as mobile phones and PDAs—to deliver right time health services to customers (or, patients).This service system centers on "creating uplifting changes and improvements in the well-being of both individuals and communities" (Ostrom et al., 2010). Although this service system creates positive changes, there are growing concerns about the overall service quality of such services, and their impact on critical service outcomes (Ahluwalia & Varshney 2009; Angst & Agarwal 2009; Akter et al. 2010; Kaplan & Litwka 2008; Akter et al. 2011; Varshney 2005).

Researchers in service systems consider quality as the single most important determinant of businesses' long term success (Alter 2010). In health service system, quality is also seen as a means for achieving increased patronage, competitive advantage, long-term profitability and to ensure better health outcomes for patients (Dagger and Sweeney 2006; Dagger et al. 2007). mHealth, the new health service system, considers quality as a means for achieving perceived value, satisfaction and continuance intentions (Akter et al. 2010). This study defines service quality (SQ) as consumers' (or, patients') judgment about the overall excellence or superiority of mHealth service system (Dagger et al. 2007). The role of consumers (or, patients) in evaluating the nature of quality becomes a critical competitive consideration due to its enormous impact on outcome constructs (O'Connor et al. 2000). If the system can not be trusted to guarantee a threshold level of quality, it will have a negative impact on satisfaction and continuance intentions (Andaleeb 2001). As a result, mHealth service systems are struggling to develop meaningful quality assessment measures and their association with outcome constructs. Given the innovative nature of mHealth service system and the infancy stage of mHealth implementation, there is a paucity of matrices which can adequately measure the complexities of this new service system. A review of the literature reveals that still most of the research in this domain (i.e., mHealth service system) remains largely anecdotal, fragmented and atheoretical (Chatterjee et al. 2009; Akter et al. 2010).

Therefore, the main objective of this study is to identify the dimensions of service quality and model its overall impact on perceived value, satisfaction and continuance intentions in mHealth service systems. This modeling extends the notion of 'viewing systems as services' by embracing service systems, quality dominant logic and customer centricity concepts in the emerging service science paradigm. This extension clearly contributes to the business-technology alignment in service science by framing the impact of perceived service quality on critical service outcomes in an interdisciplinary manner.

The organization of this paper is as follows: Next section focuses on the conceptual model and hypotheses development. The subsequent section describes research methodology and empirical findings. Finally, the study discusses the implications in terms of contributions and future research directions, and provides the concluding remarks.

Conceptual Model and Hypotheses Development

The conceptual model is based on the literature in marketing, information systems and healthcare management as we focus on a technology mediated health service platform. In service systems research, such an interdisciplinary approach is important and necessary to adequately address the challenges and opportunities (Ostrom et al., 2010). In Figure 1, the conceptual model elucidates quality dominant logic in service systems by showing the associations in terms of cognitive (perceived quality & value)-affective (satisfaction)-conative (continuance intentions) framework (Oliver 1997, 1999; Bhattacherjee 2001; Taylor and Baker 1994, Cronin and Taylor 1992; Patterson 1997; Woodside et al. 1989). The model links consumer beliefs, affect, and intention within the traditional consumer attitude structure. This relationship highlights the quality dominant decision making process when we view a system as a service (e.g., B2C mHealth care). In this relationship, satisfaction plays the key mediating role between quality, value and continuance intentions. In the following sections, the study defines each construct and presents justification for all the hypotheses with further elaboration regarding the proposed relationships.

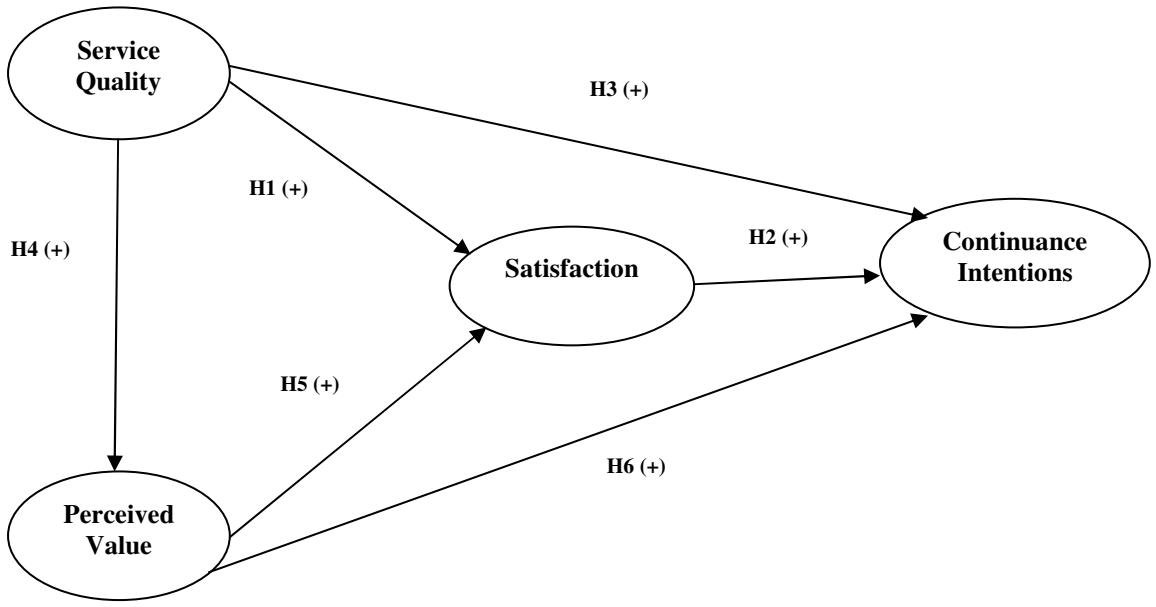

Figure 1: The role of service quality in a service system

Service Quality

Quality is an important ingredient for any service. However, quality is a complicated and indistinct concept and there is no single universal definition of quality in the literature (Brady & Cronin 2001). Due to its 'elusive' nature, research in this sector has still remained 'unresolved' (Caruana et al. 2000, p. 57). Indeed, it has remained a difficult concept to grasp (Brady & Cronin, 2001) and "far from conclusive" (Athanassopoulos 2000, p. 191). This study focuses on perceived service quality which focuses on users' perceptions about the excellence or superiority of any service. European Union's R&D in Advanced Communications technologies in Europe (RACE, 1994) program defines quality of service as "a set of user perceivable attributes of that which makes a service what it is. It is expressed in user-understandable language and manifests itself as a number of parameters, all of which have either subjective or objective values".

In order to recognize the expanding service role and to measure the performance of service systems, researchers in IS (e.g., Jiang et al. 2000, 2002; Pitt et al. 1995, 1997, Kettinger & Lee, 1994, 1995, 1999; Watson et al. 1998) have predominantly focused on SERVQUAL to measure service performance. But they faced huge challenges because of the reliability and validity of the generic SERVQUAL measures and lack of IT artifact in IS context (Van dyke et al. 1997, 1999; Orlikowski & Iacono 2001). Although such studies have been important in explaining IT usage, they are relatively abstract in capturing human technology interactions and provide limited guidance for system designers (Nelson et al. 2005). Besides, some researchers found that the application of SERVQUAL model in e-services collapse and most dimensions lose their reliability and validity (e.g., Gefen 2002). Overall, the extant literature on SERVQUAL model in IS did not focus on an integrated perspective to measure overall IT service quality. In order to address these challenges, several powerful models have been developed to address the issues of services quality over electronic platform, such as, E-S-QUAL (Parasuraman et al. 2005), electronic service quality model (Fassnacht & Koese 2006). However, these models are primarily based on front office though service quality failures are frequently related to back office operations. Since overall customer satisfaction is influenced by service quality of all moments of contact (Shaw & Ivens 2002), researchers (e.g., Parasuraman et al. 2005; Sousa & Voss, 2006) suggest incorporating both front office and back office dimensions in evaluating service quality in IT.

A review of the mobile healthcare literature reveals that there are few studies which have measured the service quality of mHealth. For instance, Varshney (2006) mentions that coverage of wireless and mobile networks, reliability of wireless infrastructure, and general limitations of hand-held devices predominantly influence quality in wireless healthcare. Chatterjee et al. (2009) evaluates mHealth using IS success framework and identifies that system quality, information quality and service quality influence mHealth success. Recently, Akter et al. (2010) presents a service quality model for mHealth; however, it did not model the impact of service quality on perceived value and related outcomes.

Synthesis of literatures in service systems brings some overlapping dimensions of service quality to measure users' perceptions. These are system quality, interaction quality and information quality. First, system quality refers to the performance of overall service delivery platform; second, interaction quality refers to the quality of interaction between provider and user over IT platform and finally, information quality indicates the quality of information service benefits. It is also agreed that no single model is absolutely better than other, so conceptualization and measurement of variables are often influenced by the context and objective of the study (DeLone & McLean 2003). Furthermore, users prefer different quality measures depending on the type of system being evaluated (Jiang et al. 1999). Thus, service quality modeling in service systems is identified as context specific, multidimensional and hierarchical (Akter et al. 2010).

Service Quality, Satisfaction and Continuance Intentions

Satisfaction plays an instrumental role in helping IT organizations clarify objectives, define measures of performance, and develop performance information systems. Rai et al. (2002), in their study to assess the validity of DeLone and McLean's (1992) and Seddon's (1997) IS success models, find that IS user satisfaction impacts IS use: a higher level of satisfaction creates greater user dependence on the system. Most of the published academic studies in the services sector have also emphasized the link between services quality and satisfaction (Dagger et al. 2007; Zineldin 2006). User satisfaction theory has argued that user satisfaction is an attitude which should be measured by the totaling of the subjective assessments of multidimensional attributes associated with the care experience (Zviran & Erlich 2003). In user-oriented health care, users and their satisfaction are considered first and foremost at every point in the planning, implementation, and evaluation of service delivery (Dagger et al. 2007, Akter et al. 2010).

Studies find both a direct relationship between service quality and satisfaction and an indirect relationship between service quality and intention to use through satisfaction (Mahmood et al. 2000, Zviran & Erlich 2003; Cronin and Taylor 1992; Dabholkar et al. 2000). DeLone & McLean (2003) confirm that service quality leads to user satisfaction and increased user satisfaction leads to future intentions to use. They highlight a strong relationship between service satisfaction and future use intentions through a meta analysis. In health services, satisfaction is generally viewed as more closely aligned with behavioral intentions. Satisfaction is typically modeled as mediating the relationship between service quality and behavioral intentions (e.g., Anderson and Sullivan 1993; Brady and Robertson 2001; Cronin and Taylor 1992; Dabholkar et al. 2000). However, in this study, we are using 'intention to continue using' instead of 'intention to use' which is defined as a usage behavior, commonly labeled as post-implementation (Saga and Zmud 1994) or post-adoption (Jasperson et al. 2005), is at least equally important to attaining service systems implementation.

Whereas 'intention to use' is related to initial adoption stage and considered a first step toward overall IS success, 'intention to continue using' focuses on how to promote continued IS use or, how to promote discontinuance (Limayem et al. 2007). Indeed, in order to consider service systems use a true success, a significant number of users should have moved beyond the initial adoption stage, using the service systems on a continued basis. Bhattacherjee (2001) confirms the viability of this construct by citing "long-term viability of an IS and its eventual success depend on its continued use rather than [its] first-time use." Thus, IS continuance intentions, IS continuance behavior, or IS continuous usage describes "behavioral patterns reflecting continued use of a particular IS which is a form of post adoption behavior" (Limayem et al. 2007). In this study, we focus on post-adoption which actually refers to a suite of behaviors that follow initial acceptance (Rogers 1995), including continuance, routinization, infusion, adaptation, assimilation, etc., which is often used as a synonym for continuance intentions in the literature (Karahanna et al. 1999). Past IS research is based on the implicit assumption that IS usage is mainly determined by 'intention to use' (in case of initial adoption), however, this assumption may not be applicable to continued IS usage behavior (Limayem et al. 2007), such as, continued usage of mobile health services. Because of lack of knowledge of continuance intentions in service systems, researchers recommend exploring this area in more detail (Akter et al. 2010). In addition, there is a research call to model the direct impact of service quality on continuance intentions and indirect impact through satisfaction in service systems. Thus, the study posits that:

H1: mHealth service quality has a significant positive impact on satisfaction.

H2: User satisfaction has a significant positive impact on continuance intentions.

H3: mHealth service quality has a significant positive impact on continuance intentions.

Service Quality, Value and Continuance Intentions

When we view a system as a service, perceived value plays a critical role in developing the service value chain for the system (Alter 2010). According to Porter & Teisberg (2004, p. 9), "In most businesses, it is common sense to create products and services that create unique value." One of the fundamental building blocks of services systems is co-creation of value (Maglio et al. 2009). Value refers to the consumer's evaluation of the utility of perceived benefits and perceived sacrifices (Zeithaml, 1988). In other words, it refers to users' perception regarding what they receive as benefits and what they give up as sacrifices in order to achieve a service (Choi et al. 2004). According to Porter & Teisberg (2004, p.5), "Payers, employers and providers pay insufficient attention to achieving better outcomes and improving value over time, which are what really matter." Superior service value represents a significant competitive advantage for the firm in building profits and customer satisfaction (Parasuraman et al. 2005). Service providers always try to increase service benefits and reduce costs or both (Sheth et al. 1999). In service Systems, service quality is widely acknowledged to play a vital role in increasing perceived value and firm's performance (Nault and Dexter 1995; Oh & Pinsonneault 2007). Service quality also streamlines business operations, increases perceived value and enhances retention (or, continuance). In mobile technology based services, value is an important parameter as firms use this channel to create superior value for customers (Kalakota and Robinson 2001). As noted by Chatterjee et al. (2009), the demand side of mHealth service is a search for value, and hence there is a need to build an understanding of the elements and special features of wireless electronic channels that are value-adding from the consumer's point of view. For mHealth consumers, the key value proposition of mobility is the creation of choice, or new freedoms, for users (Akter et al. 2010). In other words, the key advantages of mHealth include flexibility, convenience, and ubiquity. Empirical findings by Akter et al. (2011) indicate that IT continuance decisions by users are determined by their perceived value of a channel in comparison to existing alternatives. Thus, mHealth platforms create value for patients in a manner that is different from that which has been achieved in traditional healthcare platforms.

The extant literature reports that value perceptions of services will be directly influenced by perceived service quality. The relationship between service quality and perceived value is evident for healthcare (Cronin et al. 1997) and for other services (Fornell et al. 1996; Wakefield and Barnes 1996; Athanassopoulos, 2000). It is also argued that "customer satisfaction is the result of a customer's perception of the value received" (Hallowell 1996, p. 29). According to Fornell (1996. P. 9), "The first determinant of overall customer satisfaction is perceived quality. . . the second determinant of overall customer satisfaction is perceived value. ." Thus user satisfaction is highly associated with value and both these constructs are conceptually based on the overall quality attributes (Athanassopoulos 2000). According to Cronin et al. (2000, P.195), "Specifically, there has been a convergence of opinion that favorable service quality perceptions lead to improved satisfaction and value attributions and that, in turn, positive value directly influences satisfaction".

The majority of studies in marketing indicate that service quality has an indirect impact on behavioral intentions through value and satisfaction (e.g., Anderson and Sullivan, 1993; Gotlieb et al. 1994; Patterson and Spreng 1997; Roest and Pieters 1997; Taylor, 1997), though others argue for a direct impact (e.g., Boulding et al., 1993; Parasuraman et al. 1988, 1991; Taylor and Baker, 1994; Zeithaml et al. 1996). However, these findings are based on 'intention to use', not 'intention to continue using'. Furthermore, there is a paucity of research in IT services or specifically, in mHealth service systems, which explores the service quality-value-satisfaction link or, service quality-value-continuance link. Thus the study postulates that:

H4: mHealth service quality has a significant positive impact on perceived value.

H5: Perceived value has a significant positive impact on user satisfaction.

H6: Perceived value has a significant positive impact on continuance intentions.

Methodology

Research Context

This study focuses on mobile telemedicine service systems in Bangladesh, which is one of the leading mHealth service providing developing nations (Akter & Ray 2010; Akter et al. 2011). In recent years, this particular mHealth platform becomes very popular in the developing world (e.g., India, Bangladesh, Pakistan, Mexico, South Africa, Peru etc.) and serves millions by delivering right time medical services at an affordable cost (Ivatury et al. 2009). Currently, more than 24 million people in Bangladesh have access to such B2C mHealth services provided by the leading mobile operator "Grameen phone". Under this platform, a customer (or, a patient) can access health service at anytime by dialing '789' from his/her own mobile phones and receive services in the form of medical information, consultation, treatment, diagnosis, referral, treatment and counseling from registered physicians. In addition, customers who do not have their own mobile phones can access this mHealth service from local mobile phone kiosks which are widely available at every corner of the country.

Qualitative Research

In order to identify the dimensions of service quality in mHealth, this study obtained qualitative data from 3 focus group discussions and 10 depth interviews in Bangladesh. Participants ranged in age from 18 to 62 years and both genders had equal participation. The study asked the following questions to identify the service quality dimensions:

a. In your opinion, what makes mHealth different from other health services?
b. What are the major merits and demerits of mHealth services?
c. Any positive or negative experience that you had while receiving mHealth services?

The answers were recorded, synthesized and sorted into different categories to identify the core dimensions and their link to service quality constructs. In qualitative study, service quality was frequently identified as a multidimensional and context specific concept. Users expressed their opinion on different service-level attributes (e.g., "I can access mHealth whenever I want" or, "The physician shows sincere interest to solve my problems," or, "mHealth information serves my purpose") under multiple dimensions. Overall, the study found that service quality is a second order construct, which consists of three core dimensions in mHealth, that is, system quality, interaction quality and information quality.

Instrument Development

The questionnaire consists of previously published multi-item scales with favorable psychometric properties and items from qualitative research (Table 1). All the constructs in the model, except satisfaction, were measured using 7 point likert scale (e.g., strongly disagree - strongly agree). Satisfaction was measured using bi-polar semantic differential scale (e.g., very dissatisfied - very satisfied). The study developed the primary version of the questionnaire in English, and then translated the measures into the local language (Bangla). The local version was retranslated and confirmed by a panel of judges that both versions reflect the same content. Before the final study, the study conducted a pretest over 15 convenient samples to ensure that the question content, wording, sequence, format and layout, question difficulty, instructions and the range of the scales were appropriate. Upon response from the pretest, the study made context specific adjustments to refine the final version of the questionnaire.

Table 1: Operationalization of Constructs			
Model	Constructs	Operational definitions	Measures
First order Model	System Quality	Performance of mHealth platform in terms of reliability and availability.	Adapted from Parasuraman et al. (2005); Akter et al. (2010)
	Interaction Quality	Quality of communication between patients and physicians over mHealth platform.	Parasuraman et al. (2005); Akter et al. (2010)
	Information Quality	Attributes of mHealth information in terms of service benefits.	Fassnacht & Koese (2006); Akter et al. (2010)
Second order Model	Service Quality	It indicates overall excellence or superiority of the mHealth service systems. It consists of all the items of the first order model since it represents a hierarchical construct.	Wetzels et al. (2009), Bagozzi (2010), Akter et al. (2010)
Constructs in the structural model	Perceived Value	Users' trade-off between benefits and costs.	Parasuraman et al. (2005)
	Service satisfaction	Users' affect with (or, feelings) about prior mHealth services use.	Spreng et al. (1996)
	Continuance Intentions	Users' intention to continue using mHealth services.	Bhattacherjee (2001)

Sampling

Data were collected from Bangladesh under a global mHealth assessment project from January 07 to March 17, 2010. In the absence of lists for drawing a random sample, about six hundred interviews were planned from using area wise cluster sampling. A total of 623 respondents were approached, of which 480 (77%) surveys were ultimately completed. Of the total number of completed surveys, seven were considered problematic and excluded, because of excessive missing data, don't know answers, or N/A answers, and response biases. Finally, 473 surveys were analyzed. The demographic profile of the respondents represents a diverse cross section of the population (Table 2). The respondent group ranged in age from 18 to 62, were 59 percent male, 58 percent lived in rural areas, 47 percent had income less than US $ 70 per month, employed to a wide range of professions (students, professionals, self-employed, academics, farmers, housewives, day laborers, retirees), and had various educational levels (from illiterate to doctoral degrees).

Table 2: Demographic profile of respondents					
Items	Categories	%	Items	Categories	%
Gender	Male Female	59 41	**Age**	18-25 26-33 34-41 42-49 50+	25.3 31.5 21.2 16.9 5.1
Location	Urban Rural	42 58			
Income (per month in US $)	< $ 70 $ 71- $141 $ 142 - $212 $ 212 +	46.9 21.8 10.1 21.2	**Occupation**	Working full time Working part time Housewife Others	38.4 34.3 15.7 11.6

Data Analysis

Service quality in this study serves as a second order, reflective construct which consists of system quality, interaction quality and information quality as the first order dimensions. According to Bagozzi (2010, p. 209), "The second-order factor approach is most valid and conceptually meaningful when the first-order factors loading on the second-order factor can be interpreted as subdimensions or components of a more abstract, singular construct". Though covariance based SEM is the predominant approach in estimating such hierarchical model, this study uses component based SEM (or, PLS path modeling) because this method leads to higher theoretical parsimony and lower model complexity (Bagozzi and Yi 1994; Chin, 2010; Lohmoller 1989; Noonan & Wold 1983; Petter et al. 2007; Wold 1982; Edwards 2001; Law et al., 1998; MacKenzie et al., 2005; Wetzels et al. 2009). Thus, this study applies PLS path modeling to estimate the reflective, second-order service quality model through the repeated use of manifest variables (Chin and Gopal 1995; Chin 2010; Lohmöller, 1989; Wetzels et al., 2009; Wold 1985). As we have undertaken a hierarchical approach, the manifest variables will be used two times: for the first-order latent variables (e.g., system quality, interaction quality and information quality) and for the second-order latent variable (e.g., service quality) (see Table 3).

Table 3: Estimation of Service quality as a second-order, reflective Model Using PLS

First Order model	*Second order model*
$y_i = \Lambda_y \,.\, \eta_j + \varepsilon_i$ y_i = *manifest variables (e.g., items/ measures / indicators)* Λ_y = *loadings of first order latent variable* η_j = *first order latent variable (e.g., system quality, interaction quality, information quality)* ε_i = *measurement error of manifest variables*	$\eta_j = \Gamma \,.\, \xi_k + \zeta_j$ η_j = *first order factors(e.g., convenience)* Γ = *loadings of second order latent variable* ξ_k = *second order latent variable (e.g., service quality)* ζ_j = *measurement error of first order factors*

Findings

Measurement Model

In order to assess the second order reflective model of service quality, this study uses PLS Graph 3.0 (Chin 2001) to estimate the parameters in the outer and inner model. In this case, the study applies PLS path modeling with a path weighting scheme for the inside approximation (Chin 1998; Tenenhaus et al. 2005; Wetzels et al. 2009). Then the study uses nonparametric bootstrapping (Chin 1998; Efron and Tibshirani 1993; Tenenhaus et al. 2005; Wetzels et al. 2010) with 1000 replications to obtain the standard errors of the estimates. In estimating the second order service quality model, the study uses the approach of repeated indicators suggested by Wold (cf. Lohmoller 1989, pp 130-133).

A complete picture of the first-order measurement model emerges in Table 4 after applying the testing criteria and eliminating the items that damage the soundness of the criteria. The study assesses the psychometric properties of the first-order measurement model by examining reliability, convergent validity and discriminant validity. The study confirms that all the item loadings, Cronbach's alphas, composite reliabilities (CRs) and average variance extracted (AVEs) exceed the cut off values of 0.7, 0.7, 0.7 and 0.5 respectively, which ensure adequate scale reliability (Chin 1998; Fornell and Larcker 1981). This estimation also ensures convergent validity as all the PLS indicators load much higher on their hypothesized factor than on other factors (own loading are higher than cross loadings) (Chin 1998, 2010).

In addition, in Table 5, this study calculates the square root of the AVE that exceeds the intercorrelations of the construct with the other constructs in the model to ensure discriminant validity (Chin, 2010, 1998b; Fornell & Larcker 1981). Thus, the study ensures a valid measurement model with the evidence of adequate reliability, convergent validity, and discriminant validity. This process paves the way for testing the higher order measurement model and the research model.

Table 4: Psychometric Properties of the first order constructs

Constructs	Items	Loadings	Alpha	CR	AVE
System Quality	mHealth service platform is always available. I can receive health service right away. This service platform performs reliably. This service platform is dependable.	0.901 0.929 0.868 0.743	0.883	0.920	0.744
Interaction Quality	Physicians of mHealth platform provide prompt service. Physicians are willing to help me. Physicians have my best interests at heart. Physicians understand my specific needs.	0.860 0.916 0.917 0.838	0.906	0.934	0.780
Information Quality	mHealth information is complete. mHealth information is comprehensive. mHealth information is easy to understand. mHealth gives me all the health information I need.	0.786 0.818 0.831 0.815	0.828	0.886	0.660
Perceived Value	The amount of money I paid for mHealth is appropriate. The value I receive for my money is worthwhile. This service is very convenient to me. Overall, this service serves its purpose very well.	0.896 0.906 0.934 0.924	0.935	0.954	0.837
Service satisfaction	I am satisfied with my use of mHealth service. I am contented with my use of mHealth service. I am pleased with my use of mHealth service. I am delighted with my use of mHealth service.	0.949 0.952 0.950 0.935	0.961	0.971	0.896
Continuance Intentions	I intend to continue using mHealth to get medical information services. My intention is to continue using this service rather than use any alternative means (e.g., going to local clinics) I will not discontinue my use of this service.	0.939 0.923 0.962	0.936	0.959	0.886

Table 5: Mean, Standard Deviations and Intercorrelations among constructs

Construct	*Mean*	*SD*	*SQ*	*IQ*	*NQ*	*VA*	*SA*	*CI*
System quality (SQ)	5.78	0.98	0.863*					
Interaction quality (IQ)	5.75	1.12	0.456	0.883*				
Information quality (NQ)	5.64	1.18	0.523	0.526	0.812*			
Perceived value (VA)	5.74	1.17	0.438	0.429	0.547	0.915*		
Satisfaction (SA)	5.75	1.18	0.412	0.434	0.554	0.592	0.947*	
Continuance Intentions (CI)	5.59	1.26	0.438	0.350	0.501	0.521	0.572	0.941*

*square root of AVE on the diagonal.

This study also estimates the second order 'service quality' construct, which consists of 3 first order reflective constructs (system quality, interaction quality and information quality) representing (4*3) 12 items. The results show that the CR & AVE of the second order 'service quality' construct are 0.943 and 0.579 respectively, which provide evidence of a reliable measure. The degree of explained variance of the second order service quality construct is reflected in its first order components, that is, system quality (78 %), interaction quality (80%), and information quality (83 %). All the path coefficients from service quality to first order components are significant at P<0.01. The study analyzes the implications of these results in the discussion section.

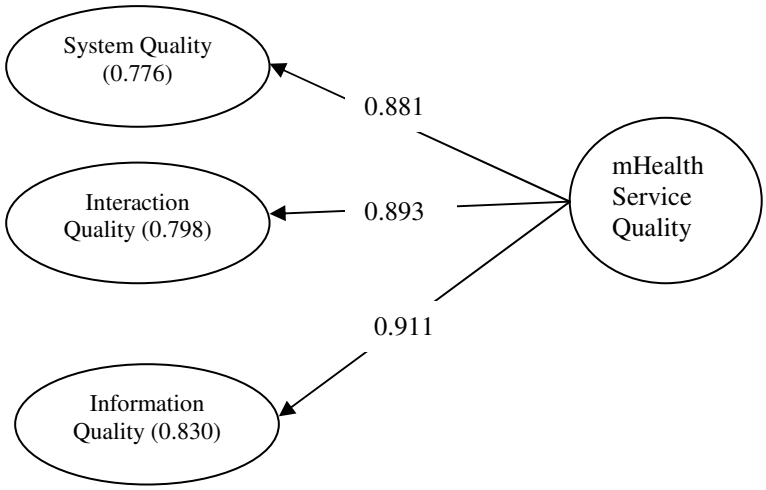

Figure 2: mHealth service quality

Structural Model

In order to assess the research model, this study estimates the impact of overall mHealth service quality on satisfaction, perceived value and continuance intentions (Figure 3). Initially, the study estimates the service quality-satisfaction-continuance link and the results give a standardized beta of 0.348 from service quality to satisfaction, 0.327 from satisfaction to continuance and 0.191 from service quality to continuance intentions. Based on these findings, this study confirms that overall mHealth service quality has both direct and indirect impact on continuance intentions, which prove H1, H2 and H3 (see Appendix). Furthermore, the study estimates the service quality-value-continuance link and the results give a standardized beta of 0.751 from service quality to perceived value, 0.531 from perceived value to satisfaction and 0.319 from perceived value to continuance intentions. These results confirm the impact of service quality on perceived value, perceived value on satisfaction, and finally, perceived value on continuance intentions, thereby proving H4, H5 and H6 respectively (see Appendix). Overall, the variance explained by the model in terms of R^2 is 0.681 for customer satisfaction, 0.564 for perceived value and 0.601 for continuance intentions, which are significantly large according to the effect sizes defined for R^2 *by* Cohen (1988).

In order to assess the overall validity of PLS based research model, first, this study estimates the power (1-β) of the model in order to assess its ability to reject a false null hypothesis (H_o) (Cohen, 1988). In this study, the power of the main effects model is 0.99 which compellingly exceeds the 0.80 cut off value. Second, this study estimates the predictive relevance (Q^2) of the endogenous constructs by using sample reuse technique based on blindfolding procedure (Stone, 1974, Geisser, 1975, Fornell and Cha, 1994, Chin, 1998a). This study obtains Q^2 of 0.595 (> 0) for satisfaction, 0.470 (> 0) for value and 0.513 (> 0) for continuance intentions, which are indicative of a highly predictive model (Chin, 2010). Finally, this study estimates the global fit (GoF) index to assess the global validity of PLS based research model (Tenenhaus et al., 2005). This study obtains a GoF index of 0.723 for the complete model, which exceeds the cut-off

value of 0.36 for the large effect size (Wetzels et al. 2009). Thus, GoF index allows us to conclude that the model has a better prediction power which adequately validates the PLS model globally.

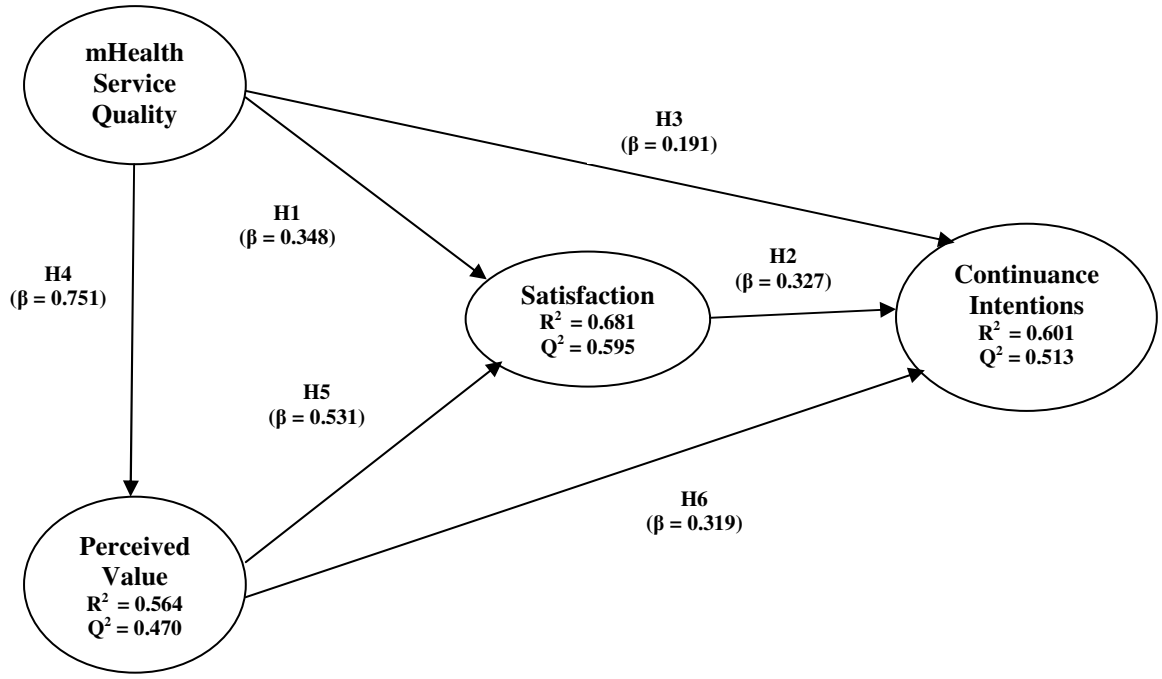

Figure 3: Results of Hypotheses Testing

Discussion

Summary of Findings

The main thrust of this study was to model the impact of service quality on satisfaction, value and continuance intentions in a service system. As such, the study developed the higher order service quality model based on three dimensions (system quality, interaction quality and information quality) and framed its impact on subsequent latent variables. The findings show that service quality in mHealth service system has a strong impact on satisfaction, value and continuance intentions. This finding highlights that the emphasis on service quality in 'systems as service' viewpoint is the perfect starting point for identifying and solving IT business problems (Alter 2010). These findings also put forward the concept of 'customer centricity' in visualizing system related problems in the business domain.

In particular, the findings suggest that all the primary service quality dimensions have a significant positive association with overall service quality. Among these dimensions, 'information quality' emerged as the strongest component, suggesting that greater gains in overall service quality can be realized by providing right information. It also indicates that it is necessary to deliver information according to the needs of customers in mHealth setting. Then 'interaction quality' was identified as an important dimension which indicates that providers must be responsive to the needs of the users. Finally, 'system quality' was identified as a key predictor of mHealth service quality which emphasizes the right time availability of this platform so that anyone can receive health services at anytime from anywhere. In the context of a low resource setting, this ubiquity is a central element in the promise of mHealth to transform the healthcare delivery system (Akter & Ray 2010). Though the study has prioritized the importance of service quality dimensions in terms of explained variance, however, the magnitude of difference among them is very small. Thus, an equal attention should be paid to all the dimensions to improve overall service quality.

The findings in the structural model confirm that overall service quality is a significant predictor of satisfaction (explaining 68 % of variance), perceived value (explaining 58 % of variance) and continuance intentions (explaining 60 % of variance). This finding is consistent with the service dominant logic (Vargo & Lusch 2008), which implies that exchange process in business should focus on perceived value and satisfaction for promoting service continuance. These findings also confirm that satisfaction and value are the key mediators or, the necessary condition for strong continuance intentions. Overall, these findings suggest that mHealth service system should consider 'service quality' as an important strategic objective to predict satisfaction, value and continuance intentions.

Contribution to Theory and Practice

Since service science research is a new area in IS domain, scholars still strive to frame its impact on critical service outcomes. According Bardhan et al. (2010), "The deployment of IS and technology by firms increasingly determines their competitiveness in the service economy. In this milieu, there is a corresponding need to apply robust research findings in the appropriate managerial and organizational contexts on services innovation, quality, architecture, and design and delivery, as well as the customer satisfaction and business value that results." Thus, this study extends the scope of service science research by modeling the impact of quality dominant logic on value, satisfaction and continuance in mHealth service systems through an expanded theory based framework. The implications of this research are highly relevant to practitioners. For managers of mHealth services, the findings of the study improve an overall understanding of how service quality is linked to critical service outcomes in a service system. According to Jia et al. (2008), "Equipped with a deeper understanding of the IT service quality phenomenon, IT managers will be enabled to improve customer service, increase customer satisfaction, and achieve stronger business- IT alignment."

Limitations

This study has several limitations. First, the context of the study is single provider, single country based. Future research could examine the sensitivity of the findings over multiple service providers in a cross country setting. Second, the study is based on cross sectional design, which contains typical limitations associated with this kind of research methodology. Future studies could undertake longitudinal study to unfold the impact of service quality on outcome constructs over time. Future Studies could also explore the impact of contextual factors, such as, demographic variables (income, education, gender etc.) and situational constructs (usage frequency, cost etc.) on the research model.

Future Research Directions

Overall, it is widely believed that viewing systems as services will vitalize research into wide scale interoperability (e.g., cloud computing, service-oriented architecture, web services, platform as a service). The service metaphor of a system will also help enhance quality and associated outcomes. It will also facilitate service systems to reconcile with mainstream service research notions. Advancing this reconciliation of currently disparate research streams remains an important research priority for service science in the foreseeable future.

Appendix: Path Coefficients and T-Statistics

Relationships	Path Coefficients	Standard Error	T-Statistics
Service Quality - System Quality	0.881004	0.027649	31.863693
Service Quality - Interaction Quality	0.893152	0.031060	28.755423
Service Quality - Information Quality	0.911246	0.023931	38.077741
Service Quality - Satisfaction	0.347840	0.107759	3.227950
Service Quality - Perceived Value	0.751072	0.051408	14.610004
Service Quality – Continuance Intentions	0.191378	0.107330	1.783083
Satisfaction – Continuance Intentions	0.326757	0.137523	2.376009
Value - Satisfaction	0.531106	0.103765	5.118366
Value – Continuance Intentions	0.319305	0.134959	2.365933

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