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Modeling quality dynamics in IT services management

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Modeling Quality Dynamics in IT Services Management

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Abstract

The increasing importance of information technology (IT) services in the global economy prompts IS researchers to focus on service quality dynamics to capture the critical interaction between human behavior and IT. The purpose of this study is to develop and validate a user perceived IT service quality model for mHealth using a cross-disciplinary approach. The conceptual model is rooted in the traditional cognition (service quality) – affective (satisfaction)– conation (continuance intentions) chain but explicitly identifies three primary dimensions (i.e., system quality, interaction quality and outcome quality) and eight subdimensions (system reliability, system efficiency, system privacy, responsiveness, assurance, empathy, utilitarian benefits and hedonic benefits) of IT service quality in mHealth. The findings of the study show that IT service quality is the third-order, reflective, hierarchical construct with strong positive effects on satisfaction and continuance intentions in mHealth context.

Keywords: *Service quality, satisfaction, continuance intentions, hierarchical modeling*.

Introduction

Service oriented thinking is one of the fastest growing paradigms in technology management as the world becomes a service economy (Bardhan et al. 2010). Services account for 70 percent of gross domestic product (GDP) and 80 percent of private-sector employment in the most advanced economies of the world (Ostrom et al. 2010). Even developing countries like India and China are experiencing more than 40% contribution in their GDP from the service sector (Lovelock et al. 2011). This service oriented growth is projected to remain constant in the foreseeable future. As such, IT organizations have started viewing systems as services in order to accelerate adoption of new platform, build business models for new technology and drive new innovation (Alter et al. 2010). It is widely believed that this growth of service oriented paradigm yields many opportunities for IS researchers to investigate the complex interaction between human behavior and IT (Rai and Sambamurthy 2006). Since this new orientation focuses on 'customers first', their perceptions play a critical role in determining the desired changes in the service systems (Alter 2010). This behavioral perspective helps IS field capture the critical dimensions of IT service by modeling the quality dynamics. Thus, to better manage service systems, IT organizations need to ensure quality both at front and back stage, that is, "how can the voice of the customer and voice of the process be matched for the best overall performance?" (ifm & IBM 2008, P. 5). Indeed, organizations should view service quality not only from the support perspective but also from systems and outcome perspectives (Oliva & Sterman 2001). Thus there is a growing need to reframe and refocus service quality in IS in order to manage the critical outcomes of service systems in an interdisciplinary manner (Ostrom et al. 2010; Alter 2010, Bardhan et al. 2010; Vargo & Lusch 2008; Akter et al. 2010).

Service quality is a multidimensional construct which includes all aspects of service delivery (Akter et al. 2010). It is defined as consumers' judgment about the overall excellence or superiority of service system (Zeithaml 1988). In service system, quality is seen as a means for achieving increased patronage and competitive advantage. Researchers in service systems consider quality as the single most important determinant of businesses' long term success (Alter 2010).The role of consumers in evaluating the nature of quality becomes a critical competitive consideration due to its enormous impact on satisfaction and continuance intentions (Akter et al. 2010). If the service system can not be trusted to guarantee a threshold level of quality, it will have a negative impact on outcome constructs. As a result, the service system approach is struggling to develop meaningful consumer-oriented quality assessment measures and their association with service outcomes. According to Bardhan et al. (2010, p.6), "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." It is noteworthy that the growing IT services including Internet search, mobile ticketing, digital wallet or mobile health (or, mHealth) are transforming organizations by enhancing service quality and innovativeness.

This study investigates quality dynamics of "mHealth" service system in the context of a developing country. 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. Although mHealth creates positive changes, there are growing concerns about the quality of such services, and their impact on perceived satisfaction and continuance intentions (Ahluwalia & Varshney, 2009; Angst & Agarwal, 2009; Ivatury et al., 2009; Kaplan & Litwka, 2008; Mechael, 2009; Varshney, 2005). 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 quality dynamics of this service system. A review of the literature reveals that still most of the research in this domain (i.e., mHealth) remains largely anecdotal, fragmented and atheoretical (Chatterjee et al., 2009).

Therefore, the aim of the study is to identify the dimensions of IT service quality in mHealth and model its overall impact on satisfaction and continuance intentions. The organization of this paper is as follows: Next section focuses on the literature review & the theoretical background for our study. Then, we conceptualize the research model and propose our hypotheses. The subsequent section describes our

research methodology and empirical findings. Finally, we discuss the implications of our research in terms of theoretical and practical contributions, and provide the concluding remarks.

Literature Review

This study is based on the literature in services marketing, information systems and healthcare management as we focus on an IT mediated health service platform. In human behavior and IT research, such an interdisciplinary approach is important and necessary to evaluate and manage IT services successfully (Bardhan et al. 2010).

Service Quality

Service quality is an important and particularly relevant construct in virtually all services (Voss et al., 2004). Service quality is a powerful concept because of its strong relationship with customer satisfaction (Cronin and Taylor, 1992; Oliver, 1993; Taylor and Baker, 1994), purchase intention (Dagger & Sweeney, 2006, Dagger et al., 2007) and firm's performance (Zeithaml et al., 1996; Boulding et al., 1993). Research in this arena still remains 'unresolved' (Caruana et al. 2000) due to its 'elusive' nature (Parasuraman et al., 1985; Smith, 1999). Indeed, this concept remains difficult to grasp (Brady & Cronin, 2001) and "far from conclusive" (Athanassopoulos 2000, p. 191). This study defines service quality as a consumer's judgment of, or impression about, a service system's overall excellence or superiority (Parasuraman et al. 2005). In service systems, customers play a critical role in defining quality and designing the service delivery systems (Alter 2010). Modeling service quality has always focused on consumers' perspectives (Parasuraman et al., 1988, 2005), and suggests that quality models should be multi dimensional (Brady & Cronin 2001), hierarchical (Rust and Oliver, 1994; Dabholkar et al., 1996), and context specific (Babakus & Boller, 1992; Carman, 1990; Dabholkar et al., 1996; Dagger et al., 2007).

Service Quality in IT

In order to recognize the critical role of service quality in IT, researchers (e.g., Jiang et al. 2000, 2002; Pitt et al., 1995, 1997, Kettinger & Lee, 1994, 1995, 1999, Watson et al. 1998, Ma et al. 2005; Jia et al. 2008) have predominantly focused on SERVQUAL model. 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 service performance, they are relatively abstract in capturing human technology interactions and provide limited guidance for system designers (Nelson et al. 2005). Though Nelson et al. (2005) presented an IT quality model based on systems quality and information quality in order to establish IT artifact in IS quality literature. However, this research was conducted within the specific domain of data warehousing, so authors expressed their concern about the applicability of findings more broadly or to other specific forms of technology (Nelson et al. 2005). Furthermore, this study was not based on ultimate users' point of view and did not include any construct to measure service quality. IS scholars (e.g., DeLone & McLean 2003, Petter et al. 2008) recommend that 'provider-user interaction' should be included as an important dimension to measure IT support, especially in the electronic service environment where customer service is crucial. In the e-commerce domain, though several powerful models have been developed to address the issues of 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 dimension though service quality failures are frequently related to back office operations (i.e., Information Systems). Since satisfaction is influenced by service quality of all moments of contact (Shaw & Ivens 2002), researchers (e.g., Sousa & Voss, 2006; Alter 2010) suggest integrating both front office and back office dimensions in evaluating IT service quality.

Service Quality in mHealth Service System

The extant literature identifies that there is no theoretical model that can reliably and validly measure IT service quality in mHealth environment (Akter & Ray 2010). However, there are some predominant factors which influence users' quality perceptions in this domain. As such, this study proposes that users perceive service quality at three dimensions: system quality (e.g., system reliability, system efficiency, and system privacy), interaction quality (e.g., responsiveness, assurance and empathy) and outcome quality (utilitarian and hedonic benefits). The literature also indicates that overall service quality influences satisfaction and satisfaction, in turn, positively influences continuance intentions (Dagger et al. 2007).

Conceptual Model

The conceptual model depicted in figure 1 elucidates an overview of associations in terms of cognitive (service quality)-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 service quality dominant decision making process for a service system (e.g., B2C mHealth care) with an effect on individual (satisfaction) and organizational (i.e., continuance intentions) outcomes. The model conceptualizes IT service quality as a higher order construct, which consists of eight first order dimensions (system reliability, system efficiency, system privacy, responsiveness, assurance, empathy, utilitarian and hedonic benefits) and three second order dimensions (system quality, interaction quality and outcome quality). In the following section, the study defines each construct and presents justification for all the hypotheses with further elaboration regarding the proposed relationships.

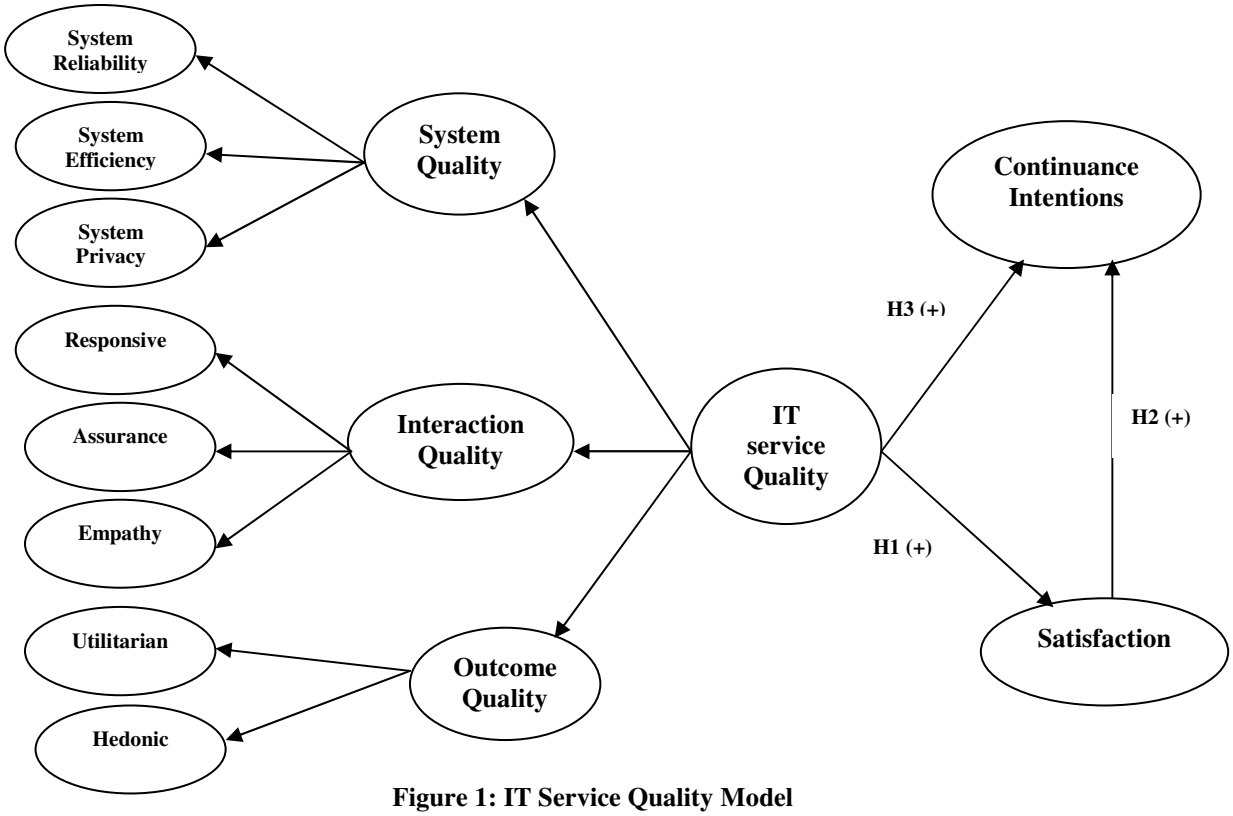

Figure 1: IT Service Quality Model

System Quality

This study proposes *system quality* as a construct of IT service quality in mHealth, which captures user's perceptions regarding technical level of communication (Parasuraman et al. 2005; Petter & McLean 2009, Delone & McLean 2003). In our case, it measures overall service delivery systems in terms of system reliability, system efficiency, and system privacy (Parasuraman et al.2005). This study observes that when a user receives medical service from mHealth platform, he/she perceives quality of the service platform (Information Systems) in terms of ease of use, ease of access, availability, speed of response, privacy of information etc.

Interaction Quality

This study incorporates *interaction quality* in order to measure intensive interaction between patients and physicians over mobile platform in the form of medical consultation. In this case, we are adopting the definition Bitner (1990) as "a period of time during which a consumer directly interacts with a service". To measure interpersonal interaction quality, SERVQUAL theory (Parasuraman 1985, 1988) is quite popular in marketing as well as in Information Systems (Pitt et al. 1997; DeLone & McLean 2003). This study observes that when a patient interacts with a physician over mHealth platform, he or she perceives quality in terms knowledge and competence of the provider, promptness in providing solutions and individual attention to the needs.

Outcome Quality

Finally, this study proposes *outcome quality* as one of the dimensions of IT service quality, which refers to the service benefits of mHealth platform (Fassnacht & Koese 2006). Specifically, it refers to the characteristics of the information offered by the system in terms of service fulfillment, usefulness and enjoyment (DeLone & McLean 2003, Petter & McLean 2009). It is very important to evaluate outcome quality for any health service (Dagger et al. 2007) in order to measure utilitarian and hedonic benefits (Sheth et al. 1991; Fassnacht & Koese 2006). Here, utilitarian benefits refer to the functional benefits of information to address' medical problems and hedonic benefits refer to the emotional benefits of information to their mental health.

Hypotheses Development

To embed hierarchical service quality in a nomological network, we have modeled it with outcome constructs, such as, service satisfaction and intention to continue using. We define 'satisfaction' as the overall attitudinal response toward mHealth services (Dabholkar et al. 1996) and 'intention to continue using' as the behavioral patterns reflecting continued use of mHealth services (Limayem 2007), which represents post-implementation (Saga and Zmud, 1994) or post-adoption behavior (Jasperson et al., 2005).

IS researchers (e.g., Nelson et al. 2005; DeLone & McLean 2003) used a quality based approach for measuring user satisfaction and suggests that it is an indispensable indicator to measure IS performance. The impact of service quality on patient satisfaction is a dominant concern in the health services (Dagger et al. 2007). In healthcare, service quality is increasingly used as an instrumental tool to satisfy users, identify target groups, clarify objectives, define measures of performance, and develop performance information systems (Dagger & Sweeney 2006). This study links service quality and satisfaction to continuance intentions in order to predict the economic outcome in terms of repeat purchase, customer loyalty, propensity to pay more, reduction in switching and above all, increasing market share and return of investment (Bolton, 1998; Bolton and Lemon, 1999; Andaleeb, 2001; Mittal and Kamakura, 2001; Verhoef, 2003; Zeithaml et al., 1996; Rust and Zahorik, 1993). Research on mHealth continuance will likely facilitate its critical impact evaluation in order to move beyond discussions of the potential impact that they might have and anecdotal examples of current use (Mechael, 2009).

Thus, this study explores the link between quality-satisfaction-continuance intentions in mHealth service systems and posits that:

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

H2: Satisfaction has a significant positive impact on continuance intentions in mHealth.

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

Nature of the IT Service Quality Model

We specify the proposed IT service quality model as the third-order, reflective model in which indicators are manifestations of construct (Jarvis et al.2003; Petter et al. 2007). The extant research on IT quality (Nelson et al. 2005) and measurement model specifications (Wetzels et al.2009) has always embraced such hierarchical, reflective view.

We define the proposed IT service quality model as a hierarchical model because it involves constructs more than one dimension (Edwards 2001, Jarvis et al. 2003; Law and Wong 1999; Law et al. 1998; MacKenzie et al. 2005; Netemeyer et al. 2003; Petter et al. 2007). It can be distinguished from unidimensional constructs, which are characterized by a single underlying dimension (Netemeyer et al. 2003). Hierarchical modeling has several advantages, first, it allows for more theoretical parsimony and less model complexity (MacKenzie et al. 2005). Second, it establishes theoretical rigor because general constructs are divided into specific dimensions or facets (Edwards 2001). Third, it enables to match the level of abstraction for predictor and criterion variables. Finally, such modeling helps establish a higher degree of scale reliability and validity. Most importantly, hierarchical constructs have a tendency to provide a higher degree of criterion validity if they perform as predictors (Wetzels et al.2009).

Furthermore, we specify that the proposed research model is reflective because direction of causality is from construct to items, all the indicators in our model share a common theme, they are interchangeable, covary with each other and dropping an indicator should not alter conceptual domain of the construct (Jarvis et al. 2003; Petter et al. 2007). Formally, if *X1* is a latent variable and $Y_1, Y_2 \ldots\ldots Y_n$ a set of observable indicators, the reflective specification implies the following equation (Table 1), where β_i is the expected effect of X on Y_i where ε_i is the measurement error for the i_{th} indicator ($i= 1, 2, \ldots\ldots n$). It is assumed that COV (X, ε_i) = 0, and COV ($\varepsilon_i, \varepsilon_j$)= 0, for $i \neq j$ and E (ε_i) = 0.

Table 1: IT service Quality : A reflective model

Nature of the Model	**Reasons for Reflective Model**
$Y_i = \beta_{i1} X_1 + \varepsilon_i$ **Where,** Y_i = the i^{th} indicator β_{i1} = coefficient represents effect of latent variable on indicator X_1 = latent variable ε_i = measurement error for indicator *i* *Each indicator of a reflective construct is represented by its own equation.	• Direction of causality is from construct to items & indicators are manifestations of the construct. • Changes in the construct do cause changes in the indicators. • Indicators are interchangeable, having a common theme and dropping of an indicator should not change the conceptual domain of construct. • Indicators are expected to covary with each other. • Indicators are required to have the same nomological net.

Methodology

Research Context

This study focuses on mobile telemedicine services in Bangladesh, which is one of the leading mHealth service providing developing nations (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 information services at an affordable cost (Ivatury et al., 2009; Akter et al., 2011). 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.

Instrument Development

The questionnaire consists of previously published multi-item scales with favorable psychometric properties (see Table 2). 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 2: Operationalization of Constructs: IT service Quality Model

Construct	Definitions	Measures
System Reliability	The degree to which mHealth platform is dependable over time.	Adapted from Parasuraman et al. (2005), Akter et al. (2010)
System Efficiency	The degree to which mHealth platform can adapt to a variety of user needs and changing conditions.	
Systems Privacy	The degree to which mHealth platform is safe and protects user information.	
Responsiveness	It refers to the willingness of physicians to help patients and provide prompt service over mHealth platform.	Parasuraman et al. (1988), Akter et al. (2010)
Assurance	It measures knowledge of the health service provider to inspire trust and confidence.	
Empathy	It measures caring and individualized attention of the provider to its users.	
Utilitarian Benefits	The extent to which the mHealth service serves its actual purpose.	Fassnacht & Koese (2006); Akter et al. (2010)
Hedonic Benefits	The extent to which using the mHealth service arouses positive feelings.	
Satisfaction	Users' affect with (or, feelings about) prior mHealth services use.	Spreng et al. (1996)
Continuance Intentions	Users' intentions 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 using area wise cluster sampling. A total of 507 respondents were approached, of which 325 (64%) 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, 311 surveys were analyzed. The demographic profile of the respondents represents a diverse cross section of the population. 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).

Data Analysis

This study applies PLS path modeling (or, Component based structural equation modeling) in estimating the hierarchical model in order to achieve more theoretical parsimony and less model complexity (Chin 2010; Edwards 2001; Law et al. 1998; MacKenzie et al. 2005, Wetzels et al. 2009). Besides, it is suitable for this study because it can give more accurate estimates of higher order constructs by accounting for the measurement error that attenuates the estimated relationships. Also, PLS works better when the objective is 'prediction', the model is relatively complex, and the phenomenon under study is new or changing (Chin & Newsted 1999). Overall, it ensures robust solutions in estimating complex relationships among variables (Chin 2010). As we have undertaken a hierarchical approach, the manifest variables will be used three times: for the first-order latent variable (e.g., system efficiency), for the second-order latent variable (e.g., systems quality) and for the third-order latent variable (IT service quality) (see Table 1). According to Wetzels et al. (2009), *"This approach also allows us to derive the (indirect) effects of lower-order constructs, or dimensions, on outcomes of the higher-order construct."*

Table 3: Estimation of the third-order reflective hierarchical IT quality model using PLS path modeling

First Order model	Second order model	Third order model (Extension of second order model)
$y_i = \Lambda_y . \eta_j + \varepsilon_i$ y_i = manifest variables (*e.g., items of system reliability*) Λ_y = loadings of first order LV η_j = first order LV (e.g., System reliability) ε_i = measurement error	$\eta_j = \Gamma . \xi_k + \zeta_j$ η_j = first order factors Γ = loadings of second order LV ξ_k = second order LV *(e.g., system quality)* ζ_j = error of first order factors	$\eta_j = \beta . \eta_j + \Gamma . \xi_k + \zeta_j$ η_j = Second order factors $\beta \ \eta_j$ = Higher order LVs with loadings (i.e., from first to the n^{th} order, except the highest order) $\Gamma \ \xi_k$ = The highest order LV with loadings (i.e., *IT service quality)* ζ_j = error of second order factors

Findings

Measurement Model

In order to assess the third order, reflective model of service quality, the 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. 2010). It also applies nonparametric bootstrapping (Chin 1998; Efron and Tibshirani 1993; Tenenhaus et al. 2005; Wetzels et al. 2009) with 500 replications to obtain the standard errors of the estimates. In estimating the third-order service quality model, the study uses the approach of repeated indicators suggested by Wold (cf. Lohmoller, 1989, pp 130-133).

Table 4: Psychometric Properties for First Order Constructs

Constructs	Items	Loadings	Alpha	CR	AVE
System Reliability	mHealth platform is always available. I can access whenever I need. I can receive service right away. It does not have long waiting time.*	0.893 0.925 0.936	0.907	0. 941	0.843
System Efficiency	This system is simple to use. It is easy to get service from this system. This system is flexible to meet variety of needs. It is well organized.*	0.920 0.961 0.921	0.926	.953	.872
System Privacy	It protects my personal information. It does not share information with others. It offers me a meaningful guarantee.*	0.969 0.968	0.933	0. 967	0.938
Responsiveness	Physicians of mHealth are always willing to help me. They show interest to solve my problems. They provide service right at the first time. They provide the service by a certain time.*	0.905 0.912 0.906	0.893	0.933	0.824
Assurance	Their behavior instills confidence in me. I feel safe while consulting with them. They are competent in providing service.*	0.935 0.925	.844	0.928	0.865
Empathy	Physicians give me personal attention. Physicians give me individual care. Physicians understand my specific needs.	0.931 0.940 0.874	0.902	0.939	0.837
Utilitarian Benefits	mHealth information serves its purpose very well. Having information from it has been worthwhile. Overall, this information service is useful to me. It is enjoyable to use this information service.*	0.814 0.840 0.834	0.773	0.868	0.688
Hedonic Benefits	I feel hopeful as a result of having information. I feel encouraged having this information. I believe my future health will improve having this information service.	0.961 0.952 0.945	0.902	0.967	0.907
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 0.951 0.934	0.961	0.971	0.895
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 0.961	0.936	0.958	0.885

*items eliminated due to low factor loadings or cross loadings.

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, all the hypotheses and proving the research model.

Table 5: Mean, Standard Deviation (SD) and intercorrelations of the latent variables for the first order constructs*

Construct	*Mean*	*SD*	*SR*	*SE*	*SP*	*RE*	*AS*	*EM*	*UB*	*HB*	*SAT*	*CI*
System Reliability (SR)	*5.673*	*1.144*	*0.918*									
System Efficiency (SE)	*5.500*	*1.186*	*0.460*	*0.934*								
System Privacy (SP)	5.315	1.240	0.278	0.451	*0.969*							
Responsiveness (RE)	5.993	1.110	0.549	0.583	0.310	*0.908*						
Assurance (AS)	5.575	1.257	0.452	0.590	*0.470*	*0.597*	*0.930*					
Empathy (EM)	5.820	1.149	0.442	0.551	0.429	0.632	*0.695*	*0.915*				
Utilitarian Benefits (UB)	5.730	1.053	0.523	0.630	0.438	0.639	*0.765*	*0.734*	*0.830*			
Hedonic Benefits (HB)	5.550	1.249	*0.556*	*0.612*	*0.402*	*0.646*	*0.402*	*0.724*	*0.789*	*0.952*		
Satisfaction (SAT)	5.555	1.087	*0.558*	*0.533*	*0.381*	*0.591*	*0.695*	*0.659*	*0.729*	*0.714*	*0.946*	
Continuance Intentions (CI)	5.524	1.313	*0.461*	*0.499*	*0.355*	*0.544*	*0.609*	*0.567*	*0.691*	*0.679*	*0.728*	*0.941*

In table 6, this study confirms the psychometric properties of the higher order model. The study estimates the third order, IT service quality construct, which consists of 3 second order reflective constructs (system quality, interaction quality and outcome quality) representing 22 (3+3+2+3+2+3+3+3) valid items. The results confirm that the CR & AVE of the second and third order constructs are greater than 0.70 and 0.50 respectively, which provide evidence of reliable higher order measures. The degree of explained variance of the third order service quality construct is reflected in its second order components, that is, system quality (74 %), interaction quality (87%), and outcome quality (85%). Accordingly, second order constructs are reflected in its first order components, such as, interaction quality is reflected in responsiveness (75%), assurance (67%) and in empathy (82%). All the path coefficients from service quality to first order and second order components are significant at $P < 0.01$. The study analyzes the implications of these results in the discussion section.

Table 6: Assessment of the Higher Order, Reflective Model							
Models	Latent constructs	AVE	CR	Dimensions	β	R^2	t-stat
Third order	Service Quality	0.51	0.96	System Quality Interaction Quality Outcome Quality	0.861 0.935 0.920	0.742 0.874 0.845	44.579 89.775 77.660
Second order	System Quality	0.53	0.90	System Reliability System Efficiency System Privacy	0.755 0.856 0.676	0.571 0.734 0.457	18.635 56.727 13.327
	Interaction Quality	0.64	0.93	Responsiveness Assurance Empathy	0.868 0.822 0.905	0.754 0.676 0.819	36.692 32.383 63.304
	Outcome Quality	0.71	0.94	Utilitarian Benefits Hedonic Benefits	0.922 0.956	0.850 0.915	75.174 169.290

Structural Model

In Figure 2, the study assesses the nomological validity of the IT service quality model in mHealth by examining its relationship with satisfaction and continuance intentions. In order to assess the nomological validity, the study uses satisfaction and continuance intentions with the hierarchical IT service quality construct. The CR and AVE of both criterion variables exceed 0.70 and 0.50 cut off value, indicating reliable measures. Overall, the results give a standardized beta of 0.765, 0.481 and 0.316 respectively from IT service quality to satisfaction, satisfaction to continuance intentions and IT service quality to continuance intentions. All these path coefficients are significant at $p < 0.001$, thus support H1, H2 and H3. Overall, the variance explained by the model in terms of R^2 is 0.585 for satisfaction and 0.564 for continuance intentions, which are significantly large according to the effect sizes defined for R^2 by Gefen (2000).

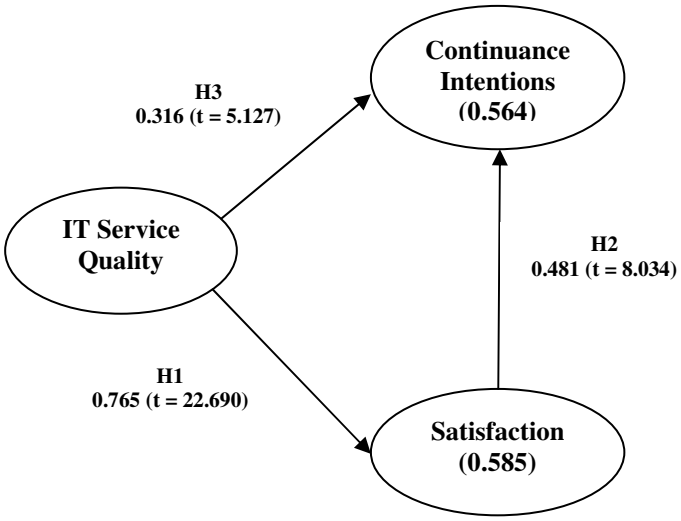

Figure 2: Results of Hypotheses Testing

Discussion

Summary of Findings

Viewing a system as a service is a new phenomenon in IS domain and scholars still strive to develop models to measure the dynamics of human behavior and IT under this paradigm. This study extends the scope this research by exploring the dimensions of IT service quality and its association with critical service outcomes in a nomological network. Thus, a unique contribution of the study is the development and validation of an IT service quality model using cross-disciplinary viewpoints in order to manage service systems effectively.

Specifically, the study identifies the components of IT service quality and frames its overall impact on satisfaction and continuance intentions in mHealth context. The proposed model is hierarchical, reflective in nature with three second-order dimensions (i.e., system quality, interaction quality and outcome quality) and eight first order dimensions (i.e., system reliability, system efficiency, system privacy, responsiveness, assurance, empathy, utilitarian benefits and hedonic benefits). The study confirms the significant positive impact of overall IT service quality on satisfaction and continuance intentions. Since the development and operationalization of a reliable and valid model is a fundamental goal of scientific endeavor, the findings of the study make an important contribution to theory and practice.

An analysis of the findings suggests that the third order, reflective service quality construct has a significant association with all the second order constructs. Among the second order dimensions, 'interaction quality' emerges as the strongest component ($\beta = 0.935$), suggesting that a vibrant interaction between users and providers over mHealth platform improves the level of quality perception. It is followed by 'outcome quality' ($\beta = 0.920$) and 'system quality' ($\beta = 0.861$) respectively, which also emerge as significant components of overall IT service quality. Accordingly, all the first order dimensions have a significant, positive association with their corresponding second order dimensions. For instance, the first order 'system reliability' ($\beta = 0.755$), 'system efficiency' ($\beta = 0.856$) and 'system privacy' ($\beta = 0.676$) explain adequate variance of the second order 'system quality' construct. Overall, the findings indicate that the third order, reflective IT service quality construct is adequately reflected in its second order and third order components.

Contribution to Theory

The IT service quality model emerges as an example of service and technology alignment in IS research, aiming to evaluate, implement, and manage service systems successfully. This service oriented perspective and quality dominant decision making enable IS research to adequately capture the complexities of human behavior and IT. It is noteworthy that human behavior affects the evolution of IT, and in turn, IT affects the way people behave. Thus, the proposed consumer perceived IT service quality model and related decision making process can help IS researchers broaden their horizon and rescope their work under the service science paradigm and the theory of service-dominant logic (Alter 2010).

Specifically, this study enriches IT service quality theory in the context of mobile health services by capturing users' perception on three primary dimensions (system quality, interaction quality, outcome quality) and eight subdimensions (system reliability, system efficiency, system privacy, responsiveness, assurance, empathy, utilitarian benefit and hedonic benefit). Besides, it adds novelty in theory by exploring the IT service quality-satisfaction-continuance link, which has not been investigated before. Methodologically, the contribution lies in validating the IT service quality theory for the first time as a third-order, reflective model using PLS, which clearly provides new insights and clarifications to component based structural equation modeling.

Contribution to Practice

A deeper understanding of the IT service quality phenomenon in mHealth will help managers improve their service process, increase customer satisfaction, and achieve stronger business - IT alignment. For managers of mHealth service systems, this finding improves understanding of how customers evaluate mHealth service quality. In particular, the findings suggest that managers of mHealth platform should focus on improving the quality of the services they provide across the three primary dimensions, which can be achieved by eight subdimensions.

The multidimensionality of the IT service quality construct suggests that a comprehensive approach is required when implementing service systems. The proposed IT service quality model provides managers with a tool for conducting an integrated analysis and design of service systems. It underscores that having only a good technological platform (e.g., information systems & good wireless network) is not enough to deliver the desired levels of service quality. Thus, managers need to address, in a coordinated manner, the quality of a platform, the quality of patient-provider interaction and above all, the quality of service benefit associated with the service platform.

Limitations

Several limitations are worth noting. First, this research was conducted within the specific domain of mHealth services and in one country. Though service quality research by its nature is context specific, replications in other contexts would increase the confidence in the research model. Second, data was collected under a cross sectional design, so the study contains the typical limitations associated with this kind of research methodology. For example, the model represents its static nature of service evaluation and the findings are confined to a single point of time. To gain a deeper understanding, this study suggests longitudinal study to evaluate users' perceptions IT service quality over time.

Future Research Directions

The world economy is gradually transforming into a service economy and the market power is shifting to consumers stakeholders (Bardhan et al. 2010). Thus, an interesting avenue for IS research is how to mass customize service design and delivery and measure the user perceptions (or, human behavior) of overall IT quality. In addition, there is a research call to explore the role of consumers in value co-creation process as consumers become the nucleus of service systems thinking.

Furthermore, because of the complex nature of human behavior and IT interaction in service systems, there is a growing emphasis on examining the trends and challenges in an interdisciplinary manner. This presents an amazing opportunity for collaboration between industry and academics. The leading industry players such as IBM, Intel, unisys, Oracle, and other have already started deriving the benefits of this collaboration by embracing service oriented thinking and quality dominant decision making.

Conclusion

With the increasing services orientation and the ever growing importance of quality dynamics, the locus of service systems is now more on customers than on business processes or organizational units. The findings of the study on customer-centric quality modeling can play a critical role to design, develop, adopt, deploy and use the service systems. The findings also provide an integrated framework to analyze the patterns of user perceptions regarding quality dynamics of IT platform that have proven so difficult over the years. Overall, these findings make an important step on the path to providing conceptual clarity and practical solutions to the quality modeling in service systems paradigm.

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