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Is Service Quality As A Multi-Dimensional Formative Construct

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Abstract

This study is motivated by, and proceeds from, a central interest in the importance of evaluating IS service quality and adopts the IS ZOT SERVQUAL instrument (Kettinger & Lee, 2005) as its core theory base. This study conceptualises IS service quality as a multidimensional formative construct and seeks to answer the main research questions: "Is the IS service quality construct valid as a 1st-order formative, 2nd-order formative multidimensional construct?"Additionally, with the aim of validating the IS service quality construct within its nomological net, as in prior service marketing work, Satisfaction was hypothesised as its immediate consequence. With the goal of testing the above research question, IS service quality and Satisfaction were operationalised in a quantitative survey instrument. Partial least squares (PLS), employing 219 valid responses, largely evidenced the validity of IS service quality as a multidimensional formative construct. The nomological validity of the IS service quality construct was also evidenced by demonstrating that 55% of Satisfaction was explained by the multidimensional formative IS service quality construct.

Keywords: IS Function, Formative construct validation, Service quality, SERVQUAL.

1 INTRODUCTION

Early attempts at information systems (IS) evaluation focused on system availability and performance (Myers, Kappelman, & Prybutok, 1997). Since then, IS performance evaluation has been investigated from two main perspectives (Ifinfedo, 2006), including: (1) IS effectiveness/success/impacts (e.g. DeLone & McLean, 1992, 2003; Gable, Sedera, & Chan, 2003, 2008), and (2) IS Function (ISF) and service quality evaluation (e.g. Chang & King, 2005; Jiang, Klein, & Carr, 2002; Pitt, Watson, & Kavan, 1997; Rabaa'i, Gable, Bandara, & Fielt, 2010; Saunders & Jones, 1992; e.g. Shaw, DeLone, & Niederman, 2002). This study is motivated by, and proceeds from, a central interest in the importance of evaluating IS service quality and adopts the IS ZOT SERVQUAL instrument (Kettinger & Lee, 2005) as its core theory base.

Petter, Straub and Rai (2007) cast doubt on the validity of many mainstream constructs employed in IS research over the past three decades and criticise the almost universal conceptualisation and validation of these constructs as reflective when in many studies the measures appear to have been implicitly operationalised as formative. Other authors, like Diamantopoulos and Winklhofer (2001) and Jarvis, MacKenzie, and Podsakoff (2003) too make this observation. Petter et al. (2007) argue that miss-specification of formative constructs can affect their validity and thus model testing. Though not explicitly acknowledged nor addressed in the services marketing literature, the SERVQUAL model is "formative" (Gable & Rai, 2009). Nonetheless, though variants of SERVQUAL have been extensively employed in IS research (as well as Services Marketing and elsewhere), validation of the IS service quality construct has to date not considered its formative nature. To the best of our knowledge, this is the first study that conceptualises IS service quality as a multidimensional formative construct, seeking to answer the main research question: "*Is IS service quality valid as a 1st-order formative, 2nd-order formative multidimensional construct?"*

The remainder of the paper will first present a brief review of relevant literature in sections two and three. Construct development is described in section four. Section five presents the research method employed in this study. Analysis and results are discussed in section six. Finally, the paper concludes with a summary, limitations and research outlook.

2 THE SERVICE QUALITY (SERVQUAL) INSTRUMENT FROM MARKETING RESEARCH

The 22-item service quality (SERVQUAL) instrument originally developed Parasuraman et al. (1988), has been of central interest to the services marketing discipline for several decades. In fact, *"the single most researched area in services marketing to date is service quality"* (Fisk, Brown, & Bitner, 1993, p: 77). The SERVQUAL instrument was developed to assess the gap between a consumer's expected and perceived level of service quality. The gap is measured in terms of the five dimensions in Table 1.

Dimension	Explanation
Tangibles	Physical facilities, equipment, and appearance of personnel
Reliability	Ability to perform the promised service dependably and accurately
Responsiveness	Willingness to help customers and provide prompt service
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence
Empathy	Caring, individualized attention the firm provides its customers

Table 1. The Five Dimensions of SERVQUAL (Parasuraman et al., 1988).

Parasuraman et al., (1988) define 'service quality' broadly as *"a global overarching judgment or attitude relating to the overall excellence or superiority of a service"*. The SERVQUAL instrument is administered as two sets of questions - one to capture expectations and one to capture perceptions. The

first part, consisting of 22 questions for measuring expectations, is benchmarked in terms of the performance of an excellent provider of the service being studied. The second part, also consisting of 22 questions, measures perceptions by framing questions in terms of the performance of the actual service provider. Service quality for each dimension is captured by a gap score (G), where G is the difference between corresponding perception of delivered service (P) and expectation of service (E) for each dimension (G = P - E).

3 THE SERVQUAL INSTRUMENT AND IS SERVICE QUALITY

Kettinger and Lee (1994) established a short form (13 items) of SERVQUAL within the IS Function (ISF) context, that evidenced the validity of the five SERVQUAL dimensions. They however reserved claims of external validity, given the context specificity of their single sample.

Pitt et al. (1995) independently analysed SERVQUAL data across three different sample sites using principal components and maximum likelihood methods, thereby deriving alternative three-, five- and seven-factor solutions. Given their findings, Pitt et al. (1995, p: 181) report that *"SERVQUAL does not clearly delineate among the dimensions of service quality"*. They warn users of the 22-item SERVQUAL to be aware of the co-alignment of the dimensions of responsiveness, assurance, and empathy due to their semantic similarity, and observe that the reliability of the tangibles dimension is low. More broadly, the use of IS SERVQUAL has been a subject of considerable debate e.g. (Fisk, et al., 1993; Kettinger & Lee, 1994; Parasuraman, Zeithaml, & Berry, 1993; Pitt, et al., 1997; Van Dyke, Kappelman, & Prybutok, 1997; VanDyke, Prybutok, & Kappelman, 1999). A focus of the debate has concerned calculating differences between two possibly different constructs, expectations and perceptions.

Kettinger and Lee (1997) conducted an empirical comparison between SERVQUAL and SERVPERF (SERVQUAL using only perceived scores - no gap measure) in terms of their relative psychometric superiority in the IS setting. While slightly better reliability and explained variance were noticed with the SERVPERF measures, neither SERVQUAL nor SERVPERF data have tended well fit the SERVQUAL five factor structure. Nonetheless, SERVQUAL has been touted for its practical relevance (Jiang, et al., 2002; Kettinger & Lee, 2005) and continues to be used to evaluate technical support service interactions (Carr, 2002). IS researchers have also expanded the use of service quality into new areas, such as measuring service quality longitudinally (Watson, Pitt, & Kavan, 1998) and internationally (Kettinger, Lee, & Lee, 1995). More recently IS researchers have also adapted service quality for use in the evaluation of electronic service environments such as e-commerce web sites (Li, Tan, & Xie, 2003; Wang & Tang, 2003) and Internet banking sites (Jayawardhena, 2004).

Kettinger and Lee (2005) reported on a study of an alternative instrument adapted from marketing referred to as the "zones of tolerance" (ZOT) service quality measure. The authors argued that this zones of tolerance measure is conceptualised to overcome a central criticism of the original SERVQUAL instrument; namely, the need for a more parsimonious conceptualisation of service quality expectations, while retaining the practical diagnostic power from gauging service expectation levels. By using a factor analysis technique, four constructs with 18 items were derived. Three original SERVQUAL constructs emerged from the exploratory factor analysis (tangibles, reliability, and responsiveness). However, two of the original dimensions, empathy and assurance, were merged into a fourth dimension. Kettinger and Lee (2005, p: 612) argued that, based on a review of the retained items and the seeming similarity of the constructs when applied in the IS context, *"the new merged construct was named rapport because the construct items focus on an IS service provider's ability to convey a rapport of knowledgeable, caring, and courteous support".* IS ZOT SERVQUAL contains measures for desired, adequate, and perceived service quality levels, and includes 18 items.

Dimension	Explanation
Reliability	The ability to perform promised ISF services dependably and accurately
Responsiveness	The willingness to help ISF users and to provide prompt service
Rapport	The ISF ability to convey a rapport of knowledgeable, caring, and courteous support
Tangibles	Physical facilities, equipment, and appearance of personnel

Table 2. The Four Dimensions of IS ZOT SERVQUAL (Kettinger & Lee, 2005)

The IS ZOT SERVQUAL instrument was pretested through a series of interviews with IS professionals and IS graduate students. After pre-testing and refining the instrument, two samples were chosen for cross validation: an initial sample from the university setting and a holdout sample from the industry setting. The findings represent an important step toward addressing past concerns with the original IS SERVQUAL's expectation measure and gap-scoring. The IS ZOT SERVQUAL instrument has strong practical potential as a diagnostic tool through which managers can quickly visualize their current IS service quality situation and design corrective actions.

4 CONSTRUCT DEVELOPMENT

4.1 Specifying Formative and Reflective Constructs

Petter et al. (2007) suggest there is significant threat of miss-specifying and miss-validating constructs as "reflective" that on closer scrutiny are in fact "formative". Miss-specification of constructs as formative or reflective results in measurement error, which impacts the structural model, thereby increasing the potential for type I and type II errors (Gable & Sedera, 2009; Gable, et al., 2008). Reflective constructs have observed measures that are affected by an underlying latent, unobservable construct (MacCallum & Browne, 1993; Petter, et al., 2007), while formative constructs are a composite of multiple measures (MacCallum & Browne, 1993; Petter, et al., 2007) (see Figure 1).

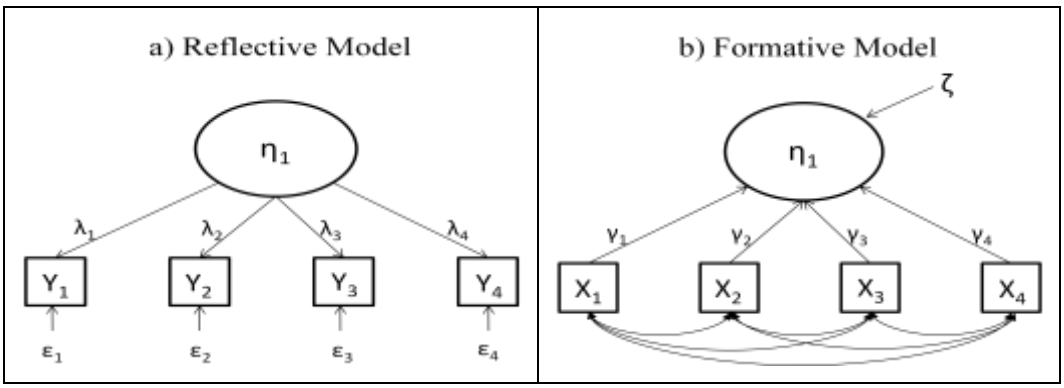

Figure 1. Specifying reflective and formative measurement models (Petter et al. (2007, p: 626)).

In the first form of specification, the reflective model (Figure 1.a), measures - i.e. indicators are referred to as *'effect'* indicators (Bollen & Lennox, 1991; MacCallum & Browne, 1993), as the co-variation among indicators is explained by variation in an underlying common latent variable (MacKenzie, Podsakoff, & Jarvis, 2005). Therefore, causality in models of this type is from the latent variable to the indicators (Diamantopoulos, Riefler, & Roth, 2008; Jarvis, et al., 2003; MacCallum & Browne, 1993). In reference to Bollen (1984), Diamantopoulos et al. (2008) characterise reflective models in two ways, namely: (1) a change in the latent variable causes variation in all measures simultaneously, and (2) all indicators in a reflective measurement model must be positively inter-correlated.

In the second form of specification, the formative mode (Figure 1.b), formative indicators "are not used to account for observed variances in the outer model, but rather to minimize residuals in the structural relationship" (Petter, et al., 2007, p: 626). In fact, formative indicators determine the latent variable, which receives its meaning from the former (Diamantopoulos, et al., 2008). That is, formative indicators 'cause' the construct (Petter, et al., 2007), as opposed to reflective indicators, which are referred to as 'effect' indicators (Bollen & Lennox, 1991; MacCallum & Browne, 1993).

Diamantopoulos and Winklhofer (2001) point out four distinct characteristics of a formative model. These include: (1) formative indicators characterise a set of distinct causes which are not interchangeable, as each indicator captures a specific aspect of the construct's domain, (2) there are no specific expectations about patterns or magnitude of inter-correlations between the indicators, (3) formative indicators have no individual measurement error terms (i.e. they are assumed to be error-free in a conventional sense), and (4) while reflective measurement models with more than two indicators are identified and can be estimated, a formative measurement model, in isolation, is 'under-identified' and cannot be estimated.

4.2 Multidimensional Constructs in a Nutshell

Multidimensional constructs are characterised as having more than one dimension (Edwards, 2001; Jarvis, et al., 2003; Law & Wong, 1999; Law, Wong, & Mobley, 1998; MacKenzie, et al., 2005; Netemeyer, Bearden, & Sharma, 2003; Petter, et al., 2007; Polites, Roberts, & Thatcher, 2011; Wetzels, Odekerken-Schröder, & van Oppen, 2009), as opposed to unidimensional constructs which have a single underlying dimension (Netemeyer, et al., 2003; Polites, et al., 2011; Wetzels, et al., 2009). Edwards (2001, p: 144) refers to multidimensional constructs as *"several distinct but related dimensions treated as a single theoretical concept"*, and each *"dimension represents a unique content domain of the broader construct"* (Polites, et al., 2011, p: 1). That is, while both multidimensional constructs and unidimensional constructs represent a single theoretical concept, they differ in that the latter lack distinct dimensions (Edwards, 2001; Polites, et al., 2011).

The use of multidimensional constructs is based on several empirical and theoretical bases (Edwards, 2001; Polites, et al., 2011; Wetzels, et al., 2009) and has generated considerable debate in the literature. Edwards (2001, p: 145) states that this debate has been ongoing for decades and shows little sign of abating. Edwards (2001, p: 145) recapitulates the views of advocates of multidimensional constructs by stating that multidimensional constructs are useful in that they *"provide holistic representations of complex phenomena, allow researchers to match broad predictors with broad outcomes, and increase explained variance"*. Additionally, multidimensional constructs allow for more theoretical parsimony (Edwards, 2001; Law, et al., 1998; MacKenzie, et al., 2005; Wetzels, et al., 2009) and allow matching the level of abstraction for predictor and criterion variables (Edwards, 2001; Wetzels, et al., 2009). Criticisms of multidimensional constructs include *"conceptually ambiguous, explain less variance than explained by their dimensions taken collectively, and confound relationships between their dimensions and other constructs"* (Edwards, 2001, p: 145). Regardless of this ongoing debate, Polites et al. (2011, p: 2) note that multidimensional constructs: *"... provide opportunities to advance IS research by enabling the capture of complex concepts in comparatively simple abstractions... Due to their potential to advance theory, multidimensional constructs have appeared with more frequency in top IS journals in recent years".*

As mentioned previously, constructs are described as multidimensional constructs when their indicators are themselves latent constructs (Edwards, 2001; Jarvis, et al., 2003; Law & Wong, 1999; Petter, et al., 2007; Polites, et al., 2011). These indicators are referred to as dimensions. Therefore, the basic distinction between the types of multidimensional constructs is the direction of the relationship between the construct and its dimensions (e.g. Edwards, 2001; Law & Wong, 1999; Petter, et al., 2007; Polites, et al., 2011). On the one hand, if the relationships point from the construct to its dimensions, the construct is referred to as *superordinate* because *"it represents a general concept that is manifested by its dimensions"* (Edwards, 2001, p: 145), and each dimension *"represents a different*

manifestation or realisation of the underlying construct" (Polites, et al., 2011, p: 5). On the other hand, if the relationships point from the dimensions to the construct, the construct is referred to as *aggregate* because *"it combines or aggregates specific dimensions into a general concept"* (Edwards, 2001, p: 145). Put differently, dimensions of an aggregate construct are combined together to form the construct (Law, et al., 1998), and these dimensions are analogous to formative measures which form the first-order constructs (Edwards, 2001)[1].

4.3 Conceptualisation of IS Service Quality in the Present Study

In this study the IS service quality construct is conceptualised as a multidimensional construct. Table 3 provides a description of the IS service quality construct's dimensions and indicators (adapted from Kettinger and Lee (2005)).

Dimension	Explanation
Reliability	The ability to perform promised ISF services dependably and accurately
Indictor 1	Providing services as promised
Indictor 2	Dependability in handling user's service problems
Indictor 3	Performing service right the first time
Indictor 4	Providing services at the promised time
Indictor 5	Maintaining reliable technology and system
Indictor 6	Prompt service to users
Responsiveness	The willingness to help ISF users and to provide prompt service
Indictor 1	Willingness to help users
Indictor 2	Readiness to respond to user's requests
Rapport	The ISF ability to convey a rapport of knowledgeable, caring, and courteous support
Indictor 1	Making users feel safer in computer transactions
Indictor 2	IS employees who are consistently courteous
Indictor 3	IS employees who have the knowledge to answer users' questions
Indictor 4	Giving users individual attention
Indictor 5	IS employees who deal with users in a caring fashion
Indictor 6	Having the user's best interest at heart
Indictor 7	IS employees who understand the needs of users
Tangibles	Physical facilities, equipment, and appearance of personnel
Indictor 1	Visually appealing facilities
Indictor 2	IS employees who appear professional
Indictor 3	Useful support materials (such as documentation, training, videos, etc...)

Table 3. The IS service quality construct (adapted from: Kettinger & Lee, 2005)

However, how a multidimensional construct is operationalised may influence analytical results of research models (e.g. Gable & Sedera, 2009; Jarvis, et al., 2003; Petter, et al., 2007; Polites, et al., 2011; Vlachos & Theotokis, 2009). Therefore, it is essential to carefully conceptualise the relationship between the first-order dimensions and their indicators and between lower-order dimensions and the higher-order construct (Polites, et al., 2011).

In this study, IS service quality is conceptualised as a formative first-order, formative second-order construct. As such, we conceptualise the four first-order dimensions (i.e. Reliability, Responsiveness, Rapport and Tangibles) as having formative indicators. In the reliability dimension, for example, the ISF may provide services at the promised time (indicator 4), but it may not be maintaining reliable technology and system (indicator 5), thus the items need not co-vary. Also, in the tangibles dimension,

[1] While a multidimensional construct (superordinate or aggregate) is conceptualised based on its dimensions *"it does not mean that it can exist separately from them"* (Edwards, 2001, p: 145). The relationships between a multidimensional construct and its dimensions "*represent associations between a general concept and the dimensions that represent or constitute the construct"*, rather than *"causal forces linking separate conceptual entities"* (Edwards, 2001, p: 146).

for example, the ISF may have visually appealing facilities (indicator 1), but it may not provide useful support materials (indicator 3). Thus, Reliability, Responsiveness, Rapport and Tangibles are formative first-order dimensions. Additionally, the IS service quality construct conceptualised in this study is formed from four first-order dimensions: Reliability, Responsiveness, Rapport and Tangibles, as identified by Kettinger and Lee (2005). Aggregating these four related dimensions of IS service quality, assumes that the dimensions collectively contribute to the second-order IS service quality construct, which can elucidate their collective effect. However, these four dimensions are likely to change over time and be affected in different ways by other factors. For instance, IS service quality may be of different levels of effectiveness and efficiency. As such, one would be mistaken to easily trade, for example, reliability of the ISF for the responsiveness of the ISF. Also, a change in the tangible aspects of the ISF, for example, does not imply a similar change in the ISF ability to convey a rapport of knowledgeable, caring, and courteous support; thereby making a reflective construct less likely. In other words, the four dimensions that form the IS service quality construct are not interchangeable. Hence, this implies that Reliability, Responsiveness, Rapport and Tangibles affect IS service quality in a formative way. Accordingly, the IS service quality construct is conceptualised as a formative-second order construct.

4.4 Satisfaction as an Immediate Consequence of IS Service Quality

Research into user satisfaction in the IS literature has been ongoing for decades (e.g. Khalifa & Liu, 2004; Sedera & Tan, 2005), and continues to be of interest to academics and practitioners, across the life-cycle of the IS (Briggs, Reinig, & de Vreede, 2008). In marketing research, Oliver and Swan (1989) define satisfaction as the consumer's fulfilment response. From an IS perspective, Doll and Torkzadeh (1988) define user satisfaction with an IS as the affective attitude towards a specific IS application by someone who interacts with the application directly. Following is a summary of the main IS satisfaction instruments identified from the literature.

User satisfaction is probably the most extensively used single measure for IS evaluation (e.g. Au, Ngai, & Cheng, 2008; Au, Ngaib, & Chengb, 2002; Briggs, et al., 2008; Doll & Torkzadeh, 1988; Etezadi-Amoli & Farhoomand, 1996; Gatian, 1994; Igbaria & Nachman, 1990; Igbaria & Tan, 1997; Iivari, 1987; Ives, Olson, & Baroudi, 1983; Sedera & Tan, 2005). However, despite the large amount of research that has been done on IS user satisfaction, with several widely cited studies and standard instruments that measure user satisfaction with IS (e.g. Bailey & Pearson, 1983; Baroudi & Orlikowski, 1988; Doll & Torkzadeh, 1988), several authors (e.g. Au, et al., 2002; Goodhue, 1995; Iivari, 1997; Khalifa & Liu, 2004; Sedera & Tan, 2005; Woodroof & Kasper, 1998) note a range of conceptual problems related to IS user satisfaction instruments, and empirical evidence of their efficiency has yielded mixed and contradictory results (Delone, 1988; Klenke, 1992; Mahmood & Becker, 1985). For example, Zviran and Erlich (2003) claim that the IS user satisfaction concept is used to refer both to the IS function and to a single IS application without always making clear the distinction between the two. Zviran and Erlich (2003, p: 87) postulate that: *"measures of user satisfaction with the information system function suffer from severe limitations as a measure of user satisfaction with a single application"*

In this study we conceptualise satisfaction as an immediate consequence of IS service quality; mainly with the goal of assessing IS Service Quality's nomological validity[2]. Nomological validity is evidenced where the formative construct behaves within a net of hypotheses as expected (Diamantopoulos & Winklhofer, 2001; Henseler, Ringle, & Sinkovics, 2009; Urbach & Ahlemann, 2010). Accordingly, those relationships between the formative construct and other model constructs which have been sufficiently referred to in prior literature, should be strong and significant (Andreev, Heart, Maoz, & Pliskin, 2009; Diamantopoulos & Winklhofer, 2001; Henseler, et al., 2009; Straub,

[2] A nomological network includes a theoretical framework of research objects, an empirical framework of how these objects will be measured, and specification of the relationships between these two frameworks (Campbell & Fiske, 1959).

Boudreau, & Gefen, 2004; Urbach & Ahlemann, 2010). The notion of having satisfaction as an immediate consequence of IS service quality has support in the marketing literature. Gable et al. (2008, p: 388) state that: *"Services marketing researchers (e.g. Anderson & Sullivan, 1993; Brady, Knight, Cronin, Hult, & Keillor, 2005; Spreng & Mackoy, 1996) employ a nomological net that positions Satisfaction as an immediate consequence of Service Quality; Satisfaction being antecedent of Behavioural Intention."*

5 THE RESEARCH METHOD

5.1 Measurement

The IS ZOT SERVQUAL instrument developed by Kettinger and Lee (2005) was used as the theory-base in this study. Recognising that the full IS ZOT SERVQUAL survey instrument, measuring both expectation and perception, is more cognitively demanding for respondents as compared to a single point (perception only) measurement approach, this study used 7-point Likert scales to evaluate only respondents' perceptions of the IS service quality. Kettinger and Lee (2005, p: 614) state that *"in cases where brevity, cost, or predictive validity concerns demand, the seemingly less clinical perception-only [...] measure might be a better option"*.

With the goal of assessing the nomological validity of IS service quality (i.e. identification through structural relations), 'Satisfaction' is included in the study model as its immediate consequence. Prior satisfaction instruments from the IS literature, such as Ives et al.'s (1983) user information satisfaction (UIS) scale or Doll and Torkzadeh's (1988) end-user computing satisfaction (EUCS) scale, are not employed in this study for the following reasons:

- these scales conceptualised satisfaction as a collection of beliefs about the information provided by an IS (e.g., accuracy, format, timeliness, reliability), rather than as affect toward the IS itself;
- these scales have been found to mix measures of multiple dimensions of IS success rather than measuring satisfaction (Sedera & Tan, 2005).

In this study, the satisfaction construct is measured using four indicators adopted from the overall satisfaction scale developed by Spreng et al. (1996) in the Expectation-confirmation theory **(**ECT) (Oliver, 1981) literature, which is yet considered a central theory for explaining satisfaction in marketing research (Cenfetelli, Benbasat, & Al-Natour, 2008).

5.2 Sample and Instrument Design

Data was collected from students of the Faculty of Information Technology at two well established public universities in Jordan[3]. Student subjects were used because they constitute a homogeneous group from an 'occupational stage of lifecycle' viewpoint. They also have frequent relationships with the central university ISF. They contact the ISF for a range of services, such as: connecting to the university-wide network, enrolment support, support of computer laboratories, consulting, training, and normal help desk assistance.

An anonymous, self-administered, hardcopy survey instrument was distributed to 265 undergraduate IT students in the two Jordanian universities; 219 usable responses were collected (82.6% response rate)[4]. The survey was divided into four sections. In the first section, respondents were asked several demographic questions for classification purposes. In the second section, respondents were asked to

[3] The data collection in Jordan involved translation effort, as the country's official language is Arabic. Several translation techniques are reported in the literature (e.g. Brislin, 1970, 1986; Hansen, 1987; Samaddar & Kadiyala, 2006). Brislin's (1986) translation technique was thought to be the most appropriate for the context of this study.

[4] Students were told that participation in the study was voluntary. However, the study was promoted by two separate high authorities in these two universities, which explains the high response rate of this study.

indicate the frequency of their contacts with their ISF and if they were familiar with the ISF services[5]. The third section measured perception of the ISF's service quality (preference items from ZOT SERVQUAL). A 7-point Likert scale was used to elicit responses to each of the 18 items, from 1 (strongly disagree) to 7 (strongly agree). The fourth section measured respondents' satisfaction with the ISF. The adopted Satisfaction scale in this study was originally designed to assess users' satisfaction with camcorder use, but has since been validated in the IS context (e.g. Bhattacherjee, 2001; Bhattacherjee & Premkumar, 2004; Ronald T. Cenfetelli, et al., 2008; Premkumar & Bhattacherjee, 2008). This adopted scale captured respondents' satisfaction levels (both in intensity and direction (Oliver, 1993, 1997)) along seven-point scales anchored between four semantic differential adjective pairs: *"frustrated/contented"*, *"displeased/pleased"*, *"terrible/delighted"*, and *"dissatisfied/satisfied"* (Bhattacherjee, 2001). The demographic profile of the sample is shown in Table 4.

IS Service Quality Items		**Mean**	**Standard Deviation**
Reliability Indicators			
Indictor 1	Providing services as promised	2.98	2.02
Indictor 2	Dependability in handling user's service problems	3.51	2.33
Indictor 3	Performing service right the first time	2.14	1.95
Indictor 4	Providing services at the promised time	2.68	1.79
Indictor 5	Maintaining reliable technology and system	3.25	2.07
Indictor 6	Prompt service to users	2.21	1.01
Responsiveness Indicators			
Indictor 1	Willingness to help users	3.45	1.55
Indictor 2	Readiness to respond to user's requests	3.51	1.65
Rapport Indicators			
Indictor 1	Making users feel safer in computer transactions	3.45	1.93
Indictor 2	IS employees who are consistently courteous	2.98	1.13
Indictor 3	IS employees who have the knowledge to answer users' questions	2.05	1.29
Indictor 4	Giving users individual attention	3.69	2.01
Indictor 5	IS employees who deal with users in a caring fashion	3.16	1.98
Indictor 6	Having the user's best interest at heart	2.36	1.48
Indictor 7	IS employees who understand the needs of users	3.54	2.55
Tangibles Indicators			
Indictor 1	Visually appealing facilities	3.45	2.47
Indictor 2	IS employees who appear professional	3.21	2.16
Indictor 3	Useful support materials (such as documentation, training, videos, etc...)	1.55	1.02
Satisfaction Indicators			
Indictor 1	Frustrated/contented	3.58	1.70
Indictor 2	Displeased/pleased	4.15	1.78
Indictor 3	Terrible/delighted	4.04	1.65
Indictor 4	dissatisfied/satisfied	3.95	1.69

Table 4. Descriptive Statistics

6 ANALYSIS AND RESULTS

To assess the validity of IS service quality as a multi-dimensional formative construct, partial Least squares (PLS) was conducted using SmartPLS 2.0 M3 (Ringle, Wende, & Will, 2005). PLS was

[5] Only respondents who were familiar with various ISF services and who have frequently used these services were considered in the data analysis of this study. Only 14 collected surveys were excluded.

chosen in this study because of its ability to: (1) model formative constructs[6], and (2) easily model multi-dimensional constructs (Wetzels, et al., 2009).

6.1 Assessment of the First-Order 'Formative' IS Service Quality Construct

Assessing formative measurement models raises the concern of whether each indicator contributes to the formative construct (Henseler, et al., 2009, p: 301). Various statistical tests can be performed to determine whether an indicator should be included in the formative construct or not (e.g. Diamantopoulos, et al., 2008; Diamantopoulos & Winklhofer, 2001; Götz, Liehr-Gobbers, & Krafft, 2010; Henseler, et al., 2009; Petter, et al., 2007; Urbach & Ahlemann, 2010), including: assessing the degree of multicollinearity and assessing indicators' weights as well as loadings.

Assessing the degree of *multicollinearity* among formative indicators is an important step in formative construct validation, as high multicollinearity could mean that the formative indicator's information is redundant (Henseler, et al., 2009)[7]. In order to check for multicollinearity, variance inflation factor (VIF) was calculated (e.g. Götz, et al., 2010; Henseler, et al., 2009; Urbach & Ahlemann, 2010)[8]. Several ordinary least squares (OLS) regressions were run, with each dimension (i.e. Reliability, Responsiveness, Rapport and Tangibles) as the dependent variable and its indicators as independent variables to obtain VIF scores. As shown in Table 5, all VIF scores are less than the suggested threshold of 10 (e.g. Gefen, et al., 2011; Götz, et al., 2010; Henseler, et al., 2009; Petter, et al., 2007). The VIF scores suggest multicollinearity is not an issue in this sample.

To assess the formative indicators' weights, a bootstrap analysis was performed with 200 subsamples and path coefficients were re-estimated using each of these samples. Results are presented in Table 5. Additionally, Table 5 presents the formative indicators' loadings with all indicators having high loadings (i.e. zero-order bivariate correlation) on the IS service quality construct. While no minimum threshold values for formative indicator weights have been established (e.g. Rai, Patnayakuni, & Seth, 2006), a high indicator weight suggests that the indicator is making a substantive contribution to the formative construct (Diamantopoulos, 2006). Additionally, a significance level of at least 0.05 suggests that an indicator is relevant and valid for the construction of the formative construct (e.g. Urbach & Ahlemann, 2010, p: 20).

For the IS service quality construct, four indicators (**bolded**) had non-significant path coefficients (i.e. non-significant weights). Since multicollinearity is unlikely to be a cause of low indicators' weights, we argue that the low weights are an artefact of the large number of indicators used to assess IS service quality, and in particular the 'reliability' (6 items) and rapport (7 items) constructs with which all four non-significant items are associated. The IS service quality construct consists of 18 indicators. This large number of formative indicators has *"important implications for the statistical significance and the magnitude of each indicator's weight"* (R. T. Cenfetelli & Bassellier, 2009, p: 694). For instance, a greater number of formative indicators will result in a greater probability that many of the indicator weights will be low in magnitude and statistically non-significant (R. T. Cenfetelli & Bassellier, 2009, p: 694).

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[6] It should be noted that LISREL can handle formative models (Jarvis, et al., 2003); however, such models are often easier to handle in PLS (Andreev, et al., 2009; Gefen, Rigdon, & Straub, 2011; Hair, Ringle, & Sarstedt, 2011).

[7] That is, multicollinearity means that specification of formative indicators was not performed successfully since formative indicators should represent distinctive characteristics of the content domain and high covariance might mean that formative indicators explain the same aspect of the domain (Andreev, et al., 2009, p: 6).

[8] The VIF indicates how much of an indicator's variance is explained by the other indicators of the same construct (Urbach & Ahlemann, 2010)

IS Service Quality Indicators	VIF	Weight	Significance	Loading
Providing services as promised	2.31	0.265	$p < 0.05$	0.724
Dependability in handling user's service problems	2.65	0.342	$p < 0.001$	0.879
Performing service right the first time	1.98	0.389	$p < 0.05$	0.693
Providing services at the promised time	1.78	0.432	$p < 0.001$	0.884
Maintaining reliable technology and system	4.64	0.287	$p < 0.05$	0.622
Prompt service to users	**5.38**	**0.103**	***ns***	**0.637**
Willingness to help users	5.91	0.170	$p < 0.01$	0.583
Readiness to respond to user's requests	2.39	0.163	$p < 0.05$	0.616
Making users feel safer in computer transactions	2.84	0.218	$p < 0.05$	0.513
IS employees who are consistently courteous	**5.91**	**0.106**	***ns***	**0.652**
IS employees who have the knowledge to answer users' questions	5.42	0.149	$p < 0.05$	0.714
Giving users individual attention	3.84	0.458	$p < 0.001$	0.786
IS employees who deal with users in a caring fashion	**5.21**	**0.092**	***ns***	**0.608**
Having the user's best interest at heart	**6.53**	**0.102**	***ns***	**0.548**
IS employees who understand the needs of users	3.22	0.284	$p < 0.05$	0.719
Visually appealing facilities	2.46	0.335	$p < 0.001$	0.843
IS employees who appear professional	2.84	0.178	$p < 0.01$	0.648
Useful support materials (such as documentation, training, videos, etc...)	1.52	0.421	$p < 0.001$	0.925

Table 5. VIFs, weights, loadings and significance of the first-order formative IS service quality indicators

Cenfetelli and Bassellier (2009, p: 695) argue that:*"formative indicators essentially "compete" with one another to be explanatory of their targeted construct. In this competition to explain variance, only a limited number of indicators will likely be significant while the others will be nonsignificant".* As such, formative constructs with relatively large number of indicators will generally have many low indicators' weights (R. T. Cenfetelli & Bassellier, 2009). Non-significant weight of a formative indicator may lead one to conclude that an indicator has no relationship with the formative construct it measures, hence, permitting its exclusion from the model. However, MacKenzie et al. (2005, p: 712) state that: "*dropping a measure from a formative-indicator model may omit a unique part of the conceptual domain and change the meaning of the variable, because the construct is a composite of all the indicators"*. One main difference between reflective and formative indicators is the extent to which an indicator is required to represent the formative construct under investigation (Jarvis, et al., 2003; Petter, et al., 2007). As a result, formative indicators are assigned beta weighs (Petter, et al., 2007). Consequently, removing a non-significant formative indicator will remove the beta weight associated with it, despite how large or small it might be (Petter, et al., 2007, p: 627).

Additionally, Cenfetelli and Bassellier (2009) argue that as important as formative indicator weights are for determining their *'relative'* contribution to their assigned construct, formative indicator weights are not the only criteria for retaining or omitting an indicator from a formative model. Cenfetelli and Bassellier (2009, p: 697) suggest that: *"it is also possible to evaluate the 'absolute' importance of an indicator to its construct. This is provided by the loading of the indicator and so its bivariate correlation with the formatively measured construct"*. Cenfetelli and Bassellier (2009) supported their argument by reflecting on what Nunnally and Bernstein (1994) refer to as "validity", the zero-order correlation between a predictor and a criterion. Cenfetelli and Bassellier (2009, p: 697) conclude that: *"just as formative indicator weights are analogous to the beta weights of a multiple regression; formative indicator loadings are analogous to this zero-order correlation. In some cases, indicators may have a low or even nonsignificant weight, and therefore a low or nonsignificant relative contribution to the construct. However, an indicator with a low or nonsignificant weight may still have an important absolute contribution if the indicator is assessed independently from the other indicators"*. Hence, the danger of assuming an item with low or non-significant weight is *'unimportant'*, despite there being a significant zero-order correlation (loading) which in the view of

(R. T. Cenfetelli & Bassellier, 2009, p: 697) evidences the importance of the item to the formative construct.

Formative indicator loadings of the IS service quality construct are presented in Table 5[9]. All non-significant formative indicators (**bolded**) have high loadings (i.e. zero-order bivariate correlation) on the IS service quality construct. This suggests that although the unique contribution of each of these non-significant indicators to IS service quality construct is small, in comparison to significant ones, there are still strong zero-order bivariate correlations between these non-significant indicators and the IS service quality construct. Hence, based on the Cenfetelli and Bassellier (2009) interpretation of formative measurement model, these results can be interpreted as:

> *While significantly related to the IS Service Quality construct, [Prompt service to users] indicator, for example, does not provide additional explanatory power once other formative indicators have been taken into account, but [Prompt service to users] is still an important aspect of IS Service Quality of its own accord.*

6.2 Assessment of the Second-Order 'Formative' IS Service Quality Construct

Following the approach of Rai at al. (2006), linear composites from the indicators used to measure each of the dimensions in the first-order (i.e. Reliability, Responsiveness, Rapport and Tangibles) were created and used as formative indicators for the IS service quality construct. Indicators' scores *'or multivariate means'* can be used to as linear composite scores, and they are based on the mean values of indicators (e.g. Rai, et al., 2006)[10] [11].

To assess the degree of multicollinearity among formative indicators, OLS regressions were run, with each dimension (i.e. Reliability, Responsiveness, Rapport and Tangibles) as the dependent variable and the other three dimensions (as calculated proceeding) as independent variables to obtain VIF scores. Table 6 represents the results. All VIFs are less than 2.65, which indicates that multicollinearity is not affecting the IS service quality data in this sample.

IS Service Quality Indicators	VIF	Weight	Significance	Loading
Reliability	1.78	0.176	$p < 0.05$	0.664
Responsiveness	2.44	0.285	$p < 0.01$	0.769
Rapport	2.65	0.218	$p < 0.05$	0.771
Tangibles	2.23	0.399	$p < 0.001$	0.855

Table 6. VIFs, weights, loadings and significance of the second-order formative IS service quality indicators

To estimate second-order formative indicator weights (i.e. path coefficients), a bootstrap analysis was performed with 200 subsamples and path coefficients were re-estimated using each of these samples, results are presented in Table 6. All second-order formative indicators have strong and significant path weights. Additionally, all second-order formative indicators show high loadings (i.e. zero-order bivariate correlation) on the IS service quality construct.

Finally, the nomological validity of the IS service quality construct was assessed by linking IS service quality with the Satisfaction construct in the nomological net. Figure 2 illustrates the results, showing that the relationship between the IS service quality construct and Satisfaction construct is strong (β =

[9] It should be noted that PLS reports zero-order bivariate correlations as loadings in tandem with the weights (e.g. R. T. Cenfetelli & Bassellier, 2009).

[10] This technique was also used by Bagozzi and Edwards (1999), Law and Wong (1999) and Edwards (2001).

[11] Put differently, the multivariate means of the manifest variables of the first-order dimensions are used as formative indicators for the second-order IS service quality construct (Rai, et al., 2006).

0.698, p< 0.001) and significant (*t*-value = 16.23), which supports the nomological validity of IS service quality construct. Also, R^2 for the Satisfaction construct of 54.7% signifies that a significant and substantial part of the variance in "Satisfaction" is explained by the IS service quality construct.

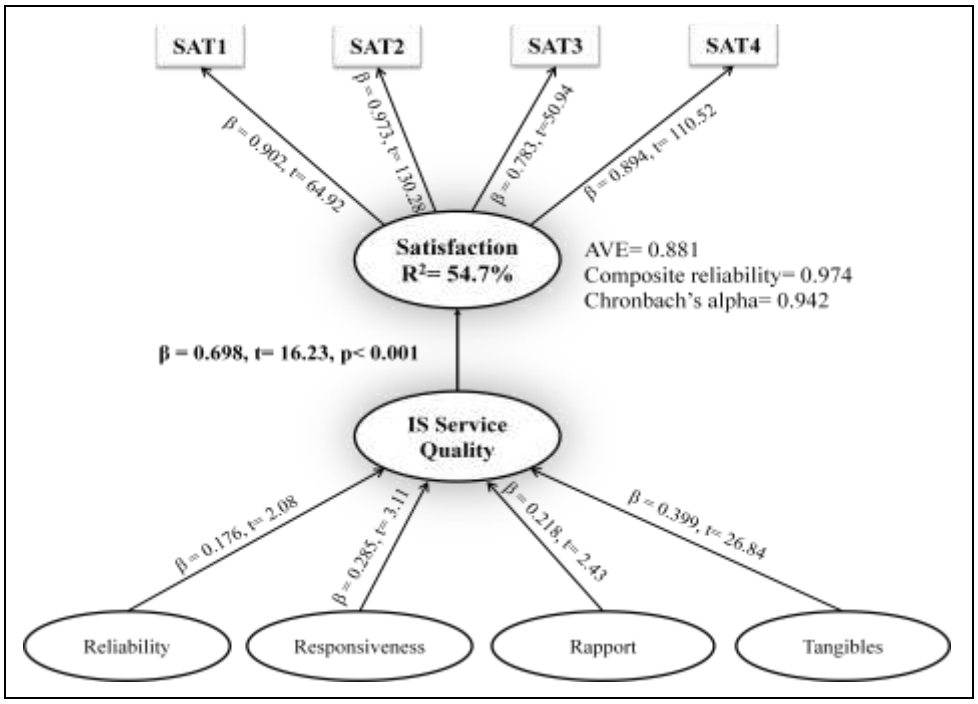

Figure 2. Nomological validity of the IS service quality construct.

7 CONCLUDING REMARKS, LIMITATIONS AND RESEARCH OUTLOOK

This study conceptualised and empirically validated IS service quality as a multidimensional formative construct with 18 formative indicators organised in 4 formative dimensions. The study too assessed the nomological validity of the IS service quality construct by employing Satisfaction as its immediate consequence.

The main research limitation of this study is not assessing the content validity of the 18 formative indicators as well as the 4 formative dimensions. The study assumes the completeness and the appropriateness of the IS ZOT SERVQUAL instrument (Kettinger & Lee, 2005). Employing the complete set of the 22 indicators of the IS SERVQUAL instrument may have resulted in a larger R^2 value of the satisfaction construct.

Another limitation of this study is not evaluating the external validity of the formative IS service quality construct. The external validity assessment for a formative construct refers to the extent to which the formative indicators actually capture the domain of the construct (e.g. Chin, 1998; Götz, et al., 2010; Henseler, et al., 2009). External validity can be assessed by regressing the formative construct on a reflective indicator of the same construct (Götz, et al., 2010; Henseler, et al., 2009). Hence, a Multiple Indicators and Multiple Causes (MIMIC) model (Hauser & Goldberger, 1971; Jöreskog & Goldberger, 1975) should be applied for the model identification procedure (Andreev, et al., 2009; Götz, et al., 2010) where both formative and at least two reflective indicators measure one construct (Diamantopoulos, et al., 2008). Reflective indicators, to assess IS service quality construct, were not used in this study; making the application of a MIMIC model impossible. Future research will look into employing different reflective indicators in combination with formative ones to assess the proposed multidimensional formative IS service quality construct external validity.

Also, both IS service quality and satisfaction constructs were validated through the single survey in this study[12]. The use of the same method makes the findings possibly subject to common method variance (CMV) bias. CMV occurs when a significant amount of spurious covariance shared among variables is attributable to the common method used for collecting the data or the source of the data (e.g. Buckley, 1990; Malhotra, Kim, & Patil, 2006; Sharma, Yetton, & Crawford, 2009). This study tried to limit the effect of CMV, if any, by employing different scales types for the independent and dependent variables (i.e. using a 7-point Likert scales for the IS service quality construct and 7-point semantic differential adjective pairs for the satisfaction construct). Future research will collect data from different respondents group to answer questions related to both IS service quality and satisfaction constructs to reduce the effect of CMV, if any, to produce a more accurate estimation of the nomological validity of the model. Sharma et al. (2009) suggested the use of multiple sources to reduce the effect of CMV. The authors specify that CMV is smallest when a perceptually anchored method is used for collecting data on independent variables (as used in this study) and a system-captured data collection method is used for dependent variables (for example, data obtained from historical records and other objective resources, such as those captured by a computer system) (Gorlaa, Somersb, & Wongc, 2010, p: 223).

[12] It should be noted that the effects of common method variance on formatively measured constructs should be assessed at the construct level, as it cannot be assessed at the indicators' level (Podsakoff, MacKenzie, Jeong-Yeon, & Podsakoff, 2003, p: 900).

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