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MEASURING IS SERVICE QUALITY IN THE CONTEXT OF THE SERVICE QUALITY-USER SATISFACTION RELATIONSHIP

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ABSTRACT

There is little research regarding the relationship between IS service quality and user satisfaction, the most frequently used surrogate for information systems success. The current study is designed to investigate three ways of measuring service quality (i.e., confirmation/disconfirmation, perception-only, and overall assessment) and shed light on the relationship between service quality and user satisfaction. The results imply that when managers try to measure service quality to improve their service, they have to be cautious in ruling out or selecting one way or another of measuring service quality. The current research also clearly shows that mangers have to take care of the service quality to enhance user satisfaction. The models and results are discussed.

INTRODUCTION

Effective information systems (IS) service has been expanding to the areas that assist and train IS users in their use of information and technology in various aspects such as hardware and software selection, trouble-shooting, and analyzing data to produce information for decision makers (Jiang, Klein, and Carr 2002; Pitt, Watson, and Kavan 1995). Another factor that causes IS department to expand its role is the tremendous growth in electronic commerce where IS department need to manage and maintain information and technology in ways that an organization can meet fast-changing customer needs in a timely manner (El Sawy, Malhortra, Gosain, and Young 2000). As the role of IS department becomes important, the quality of IS service accordingly becomes very

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critical in enabling IS users to accomplish their work more efficiently to add value to their activities and organizational performance. Thus, IS service quality over the Internet as well as within the organization has been emerged as a key success factor for business (Kettinger and Lee 1994; Moad 1989; Pitt, Watson, and Kavan 1995; Rockart 1982), in particular for electronic commerce (Riel, Semeijn, and Janssen 2003; Santos 2003; Wang and Tang 2003). This reflects a paradigm shift toward service from goods (Rust and Kannan 2003) and requires researchers to retrace the concept of IS service quality and re-examine ways of measuring the concept.

There has been a debate in IS literature pertaining to the measures of IS service quality. Most of the debate has involved the conceptual and empirical relevance of the measures of service quality, SERVQUAL and SERVPERF. Some researchers (Cronin and Taylor 1992; Cronin and Taylor 1994; Teas 1993; Teas 1994; Van Dyke, Kappelman, and Prybutok 1997; Van Dyke, Prybutok, and Kappelman 1999) contend that perception-only measures are better than confirmation/disconfirmation measures in terms of convergent and predictive validities because the perception measures readily reflect users' complex cognitive evaluation processes. The dimensionality of service quality also varies from one to eight dimensions (Kettinger and Lee 1994). Kettinger and Lee (1997) call for research that empirically proves the strength and weakness of those two measures of IS service quality in terms of the dimensionality of service quality and the role of expectation in determining the gap score (i.e., service quality). Moreover, there is a claim that in evaluating users' perception of service or product, an aggregate level of measurement reflecting users' disproportionate weighting criteria on the attributes is more effective than an attribute level of measurement (Szymanski and Henard 2001).

There is another branch of IS service quality studies that investigates the consequence of IS service quality such as user satisfaction, attitude change, and behavioral intention to use a service (e.g., Devaraj, Fan, and Kohli 2002; Jiang, Klein, and Carr 2002; Jiang, Klein, and Crampton 2000; Kettinger

CONTRIBUTION

This paper makes a contribution to IS research in several ways. This study provides answers for two crucial questions. First, this research answers the question of which has a higher influence on user satisfaction – SERVQUAL, perception-only service quality, or overall service quality. The findings of this study show that perception-only service quality and overall service quality has more impact on user satisfaction than service quality as a gap measure. Second, it also answers the question whether the relationship between perception and user satisfaction relationship is mediated by overall service quality. The results show that overall service quality mediates the relationship between service quality and user satisfaction. This comparison manifests the relative effectiveness of the aggregate level of measurement in evaluating users' perception of service or product. The findings of this study are complementary to the previous studies that focused on the dimensionality of SERVQUAL and SERVPERF or the comparison of SERVQUAL and SERVPERF in terms of their impact on overall quality or user information satisfaction.

This study also provide a basis from which to further examine the relationship between service quality and various consequences including user satisfaction, attitude toward IS service, and reuse behaviors. The understanding of this relationship is important for predicting the effectiveness of service quality in determining users' subsequent behaviors that may influence the bottom line of companies.

This research is of interest of practitioners and researchers who want to evaluate the service quality of information systems departments in various ways and the relationship between service quality and its consequences. They are able to select a model of service quality-user satisfaction illustrated in this study and add antecedents and consequences in question to test the effectiveness of IS service.

and Lee 1994). These studies report that service quality is an important determinant of user satisfaction. Hence, regardless of the dispute over the dimensionality and psychometric property of the SERVQUAL measure, the study on the relationship between IS service quality and its consequences may provide an additional insight into the debate on how to measure IS service quality as well as its role or importance to reflect the variables such as user satisfaction, attitudinal changes, etc.

Hence, the current study, considering the importance of investigating the role of service quality in determining user satisfaction as well as the current dispute about the quality of the measure, is designed to investigate the differences among confirmation/ disconfirmation, perception-only, and an aggregate measure in determining user satisfaction, which is one of the most important IS success indicators (Ives, Olson, and Baroudi 1983).

THEORETICAL BACKGROUND AND THE MODELS

IS service quality can be measured in terms of confirmation/disconfirmation between expectation and perception, or perceived quality itself. In this section, we elaborate on the differences between SERVQUAL and SERVPERF, the typical measures of service quality, and introduce an aggregate measure of service quality. We then discuss user satisfaction and elaborate on the research models.

Disconfirmation or Perception-Only

SERVQUAL is based on the confirmation/disconfirmation model (gap between expectation and perception) widely adopted in the customer satisfaction literature (Parasuraman, Zeithaml, and Berry 1988). SEVQUAL is also regarded as one of the preeminent instruments for measuring quality of IS services, which have consistently demonstrated its instrumental usefulness in IS service quality research across industries including services, finances, and manufacturing (Jiang, Klein, and Carr 2002; Jiang, Klein, and Crampton 2000; Kettinger and Lee 1994; Kettinger and Lee 1997; Pitt, Watson, and Kavan 1995; Pitt, Watson, and Kavan 1997). Moreover, SERVQUAL instrument in the information systems area is a good tool for the analysis of expectation gap between IS professionals and users (Jiang, Klein, and Carr 2002). SERVQUAL instrument consists of two parts with 22 items in each, measuring respondents' expectations and perceptions of actual service provided (Zeithamal, Parasuraman, and Berry 1990), each consisting of five dimensions: tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman, Berry, and Zeithaml 1991; Parasuraman, Zeithaml, and Berry 1988). Service quality for each dimension is captured by a difference score G (representing perceived quality gap for that item), where G = P – E. P and E are the average ratings of a dimension's corresponding perception and expectation statements respectively.

In measuring service quality with using SERVQUAL, the understanding and interpretation of expectation is critical. Prior literature (Parasuraman, Zeithaml, and Berry 1988; Parasuraman, Zeithaml, and Berry 1994; Teas 1994) showed its concern for the ways in which to define 'expectation' construct. The ill-defined 'expectation' construct may lead to varying interpretations of the expectation construct on the part of a customer, which will be elaborated further later in this section. This in turn may raise a question about using SERVQUAL scores as the proxy for service quality. It is argued that SERVQUAL scores (Van Dyke, Kappelman, and Prybutok 1997; Van Dyke, Prybutok, and Kappelman 1999) and/or both of the performance and expectation instruments (Carr 2002) possess or exhibit a lack of proper levels of psychometric properties, which may impair the efficacy of the SERVQUAL paradigm adapted for information systems area (Carr 2002).

On the contrary, SERVPERF, a direct measure of the perception of performance, consists of the same five dimensions as SERVQUAL, but focuses only on user perceptions of service quality (Cronin and Taylor 1992; Cronin and Taylor 1994). SERVPERF provides a solid means by which to capture the discrepancy between expected and perceived service quality by overcoming several shortcomings claimed by prior literature such as an ambiguity of the

expectation construct (Cronin and Taylor 1992; Cronin and Taylor 1994; Teas 1993; Teas 1994; Van Dyke, Kappelman, and Prybutok 1997). Some studies show that expectations influence only perceptions and that perceptions alone directly influence overall service quality (e.g., Boulding, Kalra, Staelin, and Zeithaml 1993).

The core arguments of perception-only measures against SERVQUAL can be found in the operationalization of disconfirmation (i.e., P-E), and the ambiguity of the expectations construct. Van Dyke and colleagues (Van Dyke, Kappelman, and Prybutok 1997; Van Dyke, Prybutok, and Kappelman 1999) argue that the use of perceptions and expectations to operationalize the service quality construct is troublesome because service quality is a complex cognitive evaluation process, in which one's perception of service quality entails expectation. In most cases, the respondents to SERVQUAL may have numerous interpretations of the expectations construct which may lead to different or even opposite impacts on perceptions of service quality. Although the detailed discussion of the different types of expectations is beyond the scope of this paper and this study sticks to the extant measures of expectation in modeling, we give some examples of the expectations to show the problems of gap measures. According to Boulding, Kalra, Staelin, and Zeithaml (1993), expectations can be described to have three separate types: will expectation, should expectation, and ideal expectation. The '*will* expectation' means what customers believe *will* happen in their next service encounter. The '*should* expectation' indicates what customers believe *should* happen in the next service encounter, while as an '*ideal* expectation' is related to what customers want in their *ideal* sense. These three different types of expectations give rise to the vague reference point problem where users may use different expectations to evaluate the service quality so that the gap scores of P-E are not appropriate to be used as a proxy of the service quality (Teas 1993; Teas 1994). This ambiguity of reference point in expectation allows advocates of the perception-only measure to assert the superiority of SERVPERF to SERVQUAL. To avoid the possible confusion, we in this study focus on the '*feasible ideal* expectation' that represents the best level of performance delivered by the best provider when measuring the expectation (Teas 1994).

Aggregate Level or Attribute Level of Measurement

Another problem of measuring the service quality lies in its dimensionality. As Kettinger and Lee (1994) summarize, the dimensionality of SERVQUAL varies from single-factor to eight-factor structure. In particular, Cronin and Taylor (1992) reported a single service quality dimension, while Kettinger and Lee (1994) used four-dimensional model including reliability, responsiveness, assurance, and empathy to examine IS department service quality. In this study, we follow Kettinger and Lee's (1994) study in terms of measurement item selection, while adopting a single factor model proposed by Cronin and Taylor (1992) to closely examine the role of expectation in determining the service quality.

Assuming a single factor model of IS service quality, we have to take care to raise the issue of aggregate level versus attribute level of measurement. In general, measuring latent variables calls for multiple measurement items. However, in consumer satisfaction and attitude research including job satisfaction research (Galletta and Lederer 1989), the use of an aggregate measure is argued and empirically proven to be more accurate than that of multiple attribute level measures (Bendapudi and Leone 2003; Bitner 1990; Szymanski and Henard 2001). This is primarily because the aggregate assessment through a single measure effectively reflect respondents' weighting scheme on specific aspects before reacting the overall assessment question (Gardner, Cummings, Dunham, and Pierce 1998; Szymanski and Henard 2001). However, linearly summated multiple-item scales may not adequately capture consumers' non-linear weighting schemes (Szymanski and Henard 2001). Based on this argument, we propose the second model that uses overall assessment of service quality.

User Satisfaction

User satisfaction is regarded as a substitute for objective determinants of IS effectiveness (Ives, Olson, and Baroudi 1983), as the most useful surrogate measure of system success (Guimaraes and Gupta 1988), and as the most useful assessment of system effectiveness (Hamilton and Chervany 1981). In this research, user satisfaction is defined as the extent to which users are satisfied with the information system itself and its environment. This definition is congruent with the definition of user satisfaction in previous studies (Galletta and Lederer 1989; Ives, Olson, and Baroudi 1983; Seddon and Kiew 1996). User satisfaction as the dependent variable of this research is argued to be directly affected by IS service quality including the evaluation of both IS department and IS systems (Pitt, Watson, and Kavan 1995). The rationale for this relationship between service quality and user satisfaction can be accounted for by the expectancy-value framework (Melone 1990; Olsen 2002; Szymanski and Henard 2001) where the users are satisfied when desired, wanted, and wished services are provided.

The investigation into the relationship between service quality and its consequences including user satisfaction may provide a strong ground for further research on service quality (Kettinger and Lee 1994; Zeithaml, Berry, and Parasuraman 1996). Recently, the studies on electronic commerce effectiveness examine the influence of the service quality on electronic commerce satisfaction and performance (Devaraj, Fan, and Kohli 2002; Liu and Arnett 2000; Santos 2003; Wang and Tang 2003).

In sum, although both SERVQUAL and SERVPERF literature (e.g., Kettinger and Lee 1994; Kettinger and Lee 1997; Pitt, Watson, and Kavan 1995; Pitt, Watson, and Kavan 1997; Van Dyke, Kappelman, and Prybutok 1997) address many issues in measuring service quality, they yielded limitations in two areas, which served as the motivation for the current study: 1) the substantive relationship between service quality and user satisfaction, and 2) the empirical test for alternative measures of service quality, i.e., confirmation/ disconfirmation, perception-only, and overall assessment of service quality. Both SERVQUAL and SERVPERF literature insist that service quality positively affects user satisfaction and the organization's performance, which should be supported by empirical evidence (Cronin and Taylor 1992; Parasuraman 2002; Pitt, Watson, and Kavan 1995; Zeithaml, Berry, and Parasuraman 1996). As discussed above, this research focuses on the relationship between the two constructs, service quality and user satisfaction, through three ways of measuring service quality. The next section elaborates the three research models to be tested.

Research Models

In this section, we elaborate three research models to answer the following research questions. First, among the service quality measures of confirmation/ disconfirmation, perception-only measures, and an aggregate measure, which one is more effective in predicting user satisfaction? This study investigates three research models: 1) Model 1: SERVQUAL (gap measure) → user satisfaction, 2) Model 2: perception → overall service quality → user satisfaction, and 3) Model 3: perception only service quality → user satisfaction. Second, is the relationship between the perception and user satisfaction mediated by overall SQ or are they directly related? Van Dyke, Prybutok, and Kappelman (1999) found that SERVQUAL explained user satisfaction more than overall service quality. This issue is worth revisiting.

Note that the service quality constructs in gap scores and perception-only in this study are assumed to have a single factor structure, i.e., a second-order factor, assessed by four-dimensional measures. Each construct has four composite scales of reliability, responsiveness, assurance, and empathy, excluding tangibility dimensions, which is congruent with Kettinger and Lee's (1994) suggestion that tangibility is not good to measure IS service quality due to its low reliability and Jiang, Klein, and Carr's (2002) justification of focusing on the four dimensions. With regard to the factor structure of service quality, previous studies that theoretically propose four or five dimensions of service quality report unstable factor structure from one to eight (e.g., Pitt, Watson, and Kavan 1995; Van Dyke, Prybutok, and

Kappelman 1999). Cronin & Taylor (1992) rather suggested that a single factor structure is enough for the service quality. In addition, the studies that have the first order factor structure indicate high correlation of over 0.65 to 0.90 among the constructs or dimensions (Jiang, Klein, and Carr 2002; Van Dyke, Prybutok, and Kappelman 1999), which can be collapsed into a single factor. Accordingly, in this study, we assume a single factor structure for service quality measured by four dimensions. Moreover, we are interested in comparing the ways of measuring the service quality and the relationship between the service quality and user satisfaction, not in the factor structure of the service quality.

Model 1: Service quality as confirmation/disconfirmation

Figure 1a shows the first conceptual model to be tested. It represents a disconfirmation framework featuring SERVQUAL as a distinctive construct that will predict user satisfaction. Consistent with Kettinger and Lee (1994) and Pitt, Watson, and Kavan (1995), service quality in this model is operationalized as gap scores, i.e., Perceptions – Expectations.

The service quality is expected to be positively associated with user satisfaction (Pitt, Watson, and Kavan 1995). If P exceeds E (i.e., positive disconfirmation), then users will be satisfied. If E exceeds P (i.e., negative disconfirmation), then user dissatisfaction will be indicated.

Model 2: Service quality as the overall assessment of service quality

Figure 1b represents a model that has the perception of the overall service quality as a surrogate for service quality and a predictor variable for user satisfaction. As discussed above, if disconfirmation (P-E) does not have significant explanatory power for user satisfaction due to its well-documented shortcomings such as the insufficient role of expectation as an ideal reference point, then there may be a need to introduce an alternative construct that mediates the effects of expectation and perception to user satisfaction. This study introduces an overall assessment of IS service quality for the alternate. The inclusion of the overall assessment construct is, as discussed in the theoretical background section, based on the argument that an aggregate (single-item) level of measurement may be more effective than an attribute (multi-item) level of measurement, because the aggregate measurement may accurately reflect users' disproportionate weighting criteria on the attributes (Szymanski and Henard 2001). This aggregate measure has a strong relationship with the perception-only measure of service quality.

Accordingly, this model features perceptions of service quality and overall assessment of service quality as distinct constructs. This model is structured in a way to assess how the attribute-level perception influences the overall perception of service quality which in turn affects user satisfaction. This model provides a tool to compare the effect of attribute-level evaluation (perception-only or gap score-based) and the overall evaluation and the impact of perception-only measures on user satisfaction.

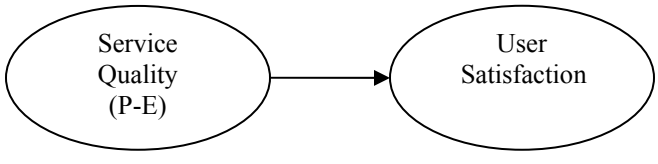


Figure 1a Model 1: Service Quality as Confirmation/Disconfirmation

Figure 1b Model 2: Service Quality as Overall Assessment of Service Quality

Model 3: Perception as service quality

Figure 1c shows a model that constitutes perception of service quality as a sole antecedent to user satisfaction. As SERVPERF studies (Cronin and Taylor 1992; Cronin and Taylor 1994; Teas 1993; Van Dyke, Kappelman, and Prybutok 1997) claimed, this model may have the potential to provide a parsimonious explanation for a complex cognitive process of user satisfaction towards IS service quality. In this study, we used perceptions-only items with its four subdimensions among the set of expectation and perception measurement items from SERVQUAL instrument, instead of using SERVPERF items directly, to assess its impact on user satisfaction. Its operationalization is elaborated in detail in the next section.

RESEARCH METHODOLOGY

Research Sample

The survey was distributed to 184 employees across all departments in a manufacturing company via its e-mail system with instructions to print a copy, complete the survey and to return it to the corporate human resources department. 72 surveys were returned and of these 71 were usable.

Approximately 56% percent of the subjects were male and 44% were female. In terms of the job, the largest groups of respondents were "distribution/warehouse" (14.9%), "information services" (14.9%), "research and development" (10.9%), and "manufacturing" (6.0%). Note that the target system is not a manufacturing system, but the information systems that support all business functions across the company. This is why the portion of manufacturing employee is only 6% in this study. The majority of the subjects have worked for one year (55.9%). Most of the subjects rated their computer expertise as good (mean 4.78 out of 7).

Operationalization of Research Variables

The items used to operationalize the constructs are found in Table 1. The current study relies on the instruments (original version) used in prior studies (Kettinger and Lee 1994; Lam and Woo 1997; Parasuraman, Zeithaml, and Berry 1988; Pitt, Watson, and Kavan 1995). The survey questionnaire included all 22 items of service quality and tested for the factor loadings. We found the low loadings (under 0.60) for tangibles as in Kettinger and Lee (1994) so that we dropped them, resulting in 18 measures of expectation and perception respectively. This use of four dimensions of service quality (reliability, responsiveness, assurance, and empathy) is also in line with Jiang, Klein, and Carr (2002).

In this study, we regarded IS service quality as a unidimensional construct as argued in Cronin and Taylor (1992) and as evidenced by high correlations among the dimensions of the service quality and perception in the confirmatory factor analysis for the measurement model (see Appendix A1 and A2 for detail). In addition, to avoid the lack of the number of observations in structural equation modeling, we aggregated the items for each sub-dimensions of service quality by averaging, to result in four measurement items (reliability, responsiveness, assurance, and empathy) for each value of expectation, perception and service quality. The results of the confirmatory factor analysis lend support for averaging the measurement items for each sub-dimension of service quality. All loadings are greater than 0.70 (except PE13, P9, and P19) and statistically significant at $p<0.001$, all goodness-of-fit indices (NFI, TLI, and CFI)

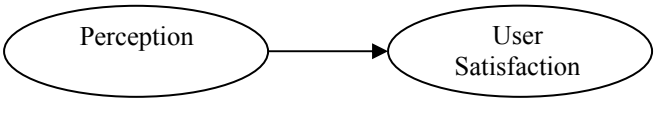


Figure 1c Model 3: Perception-Only Construct as Service Quality

Table 1. The measurement items

Dimensions	Items
Reliability	When these IS units promise to do something by a certain time, they will do so
	When users have a problem, these IS units will show a sincere interest in solving it
	These IS units will be dependable
	They will provide their services at the times they promise to do so
	They will insist on error-free records
Responsiveness	They will tell users exactly when services will be performed
	Employees will give prompt service to users
	Employees will always be willing to help users
	Employees will never be too busy to respond to users' requests
Assurance	The behavior of employees will instill confidence in users
	Users will feel safe in their transactions with these IS units' employees
	Employees will be consistently courteous with users
	Employees will have the knowledge to do their job well
Empathy	These IS units will give users individual attention
	These IS units will have operating hours convenient to all their users
	These IS units will have employees who give users personal attention
	These IS units will have the users' best interests at heart
	The employees of these IS units will understand the specific needs of their users
Overall Assessment	How would you rate the quality of service provided by the IS department
User Satisfaction	Consider that the information system environment includes the availability of the system, the ease of access to the system and ease of use of the system. How satisfied are you with the entire information system environment?
	The information system includes the applications available, the information available and the ease of retrieval of information from the system. How satisfied are you with the information system itself?

Note: All measurement items for service quality are in 1-7 Likert scale, varying from strongly disagree 1 to strongly agree 7.
Overall assessment item of service quality and two satisfaction items are in 1-7 Likert scale, varying from poor 1 to excellent 7.

are about 0.90, and normed Chi-Squares (χ^2/d.f.) of 2.1 for service quality and 1.7 for perception are less than the threshold of 3.0. In addition, Chi-square difference test indicates that the model with original five dimensions is a better fit for the data than any other model with paired dimensions (Appendix A3 and A4). Chi-square difference test is a test for discriminant validity of the constructs by comparing the Chi-squares of the original unconstrained model to those of constrained (paired constructs) model (Bagozzi, Yi, Phillips, 1991; Jiang, 2002).

One overall evaluation item is included to allow the comparison of service quality as an overall assessment of IS department service offering to service quality as confirmation/ disconfirmation between expectation and perception. This single measure for service quality is expected to better evaluate the service quality than does the attribute level measures (Galletta and Lederer 1989; Szymanski and Henard 2001).

User satisfaction with IS is measured using two overall measures (Bitner 1990;

Galletta and Lederer 1989; Seddon and Kiew 1996): user's satisfaction with systems in the light of the availability of applications and information, and the ease of retrieval from the system (Igbaria and Nachman 1990; Vijayaraman and Ramakrishna 1990) and user's satisfaction with systems' environment (Galletta and Lederer 1989) in terms of the availability, the accessibility, and the usability of the system (Igbaria and Nachman 1990; Vijayaraman and Ramakrishna 1990).

ANALYSIS AND RESULTS

Assessment of the models was conducted using the Partial Least Squares (PLS) method. PLS is effective in explaining both response and predictor variation (Chin 1998). Moreover, it is good for the current study because of the minimal demands on measurement scales, sample size, and residual distributions (Wold 1985).

PLS analysis involves two stages: (1) the assessment of the measurement model, including the reliability and discriminant validity of the measures, and (2) the assessment of the structural model. For the assessment of the measurement model, individual item loadings and internal consistency were examined as a test of reliability. Individual item loadings and internal consistencies greater than 0.7 are considered adequate (Fornell and Larcker 1981). As shown in Table 2a, b, and c, loadings for all measures are above 0.7. The loadings of the newly developed user satisfaction are also very high, revealing a high internal consistency.

Table 2a. Measures, Loadings, and Weights for Model 1

Service Quality (disconfirmation)			**User Satisfaction**		
Item	Loading	Weight	Item	Loading	Weight
SREL	0.873	0.283	UENV	0.951	0.557
SRES	0.955	0.304	UINF	0.939	0.501
SASS	0.907	0.275			
SEMP	0.800	0.268			

Table 2b. Measures, Loadings, and Weights for Model 2

Perception			**Service Quality** (overall)			**User Satisfaction**		
Item	Loading	Weight	Item	Loading	Weight	Item	Loading	Weight
PREL	0.888	0.310	SOVL	-	-	UENV	0.946	0.533
PRES	0.954	0.324				UINF	0.944	0.525
PASS	0.882	0.293						
PEMP	0.747	0.218						

Table 2c. Measures, Loadings, and Weights for Model 3

Perception (Service Quality)			**User Satisfaction**		
Item	Loading	Weight	Item	Loading	Weight
PREL	0.879	0.292	UENV	0.943	0.521
PRES	0.950	0.312	UINF	0.947	0.537
PASS	0.884	0.299			
PEMP	0.763	0.246			

Reliability and Validity Tests

In assessing the internal consistency for a given block of indicators, the composite reliability (CR), also referred to as convergent validity (see, Werts, Linn, and Joreskog 1974), was calculated. All the composite reliability values are high (over 0.90), which suggests that the parameter estimates are sound (Table 3a, b, and c).

The Average Variance Extracted (AVE) was also calculated. AVE measures the amount of variance that a construct captures from its indicators relative to the variance contained in measurement error. This statistic can be interpreted as a measure of reliability for the construct and as a means of evaluating discriminant validity (Fornell and Larcker 1981). AVE values should be greater than 0.50. All AVEs for the constructs used in this study are greater than 0.75. This indicates that more than 75% of the variance of the indicators can be accounted for by the latent variables.

The AVE can also be used to assess discriminant validity. The AVEs should be greater than the square of the correlations among the constructs. That is, the amount of variance shared between a latent variable and its block of indicators should be greater than shared variance between the latent variables. In this study, the square roots of each AVE value are greater than the off-diagonal elements (Table 4a, b, and c).

Table 3a. Composite Reliability and Average Variance Extracted for Model 1

Constructs	CR	AVE	Formula
Service Quality (Disconfirmation)	0.9353	0.7840	$CR = (\sum\lambda_i)^2 / [(\sum\lambda_i)^2 + \sum_i var(\epsilon_i)]$
User Satisfaction	0.9436	0.8932	$AVE = \sum\lambda_i^2 / [\sum\lambda_i^2 + \sum_i var(\epsilon_i)]$

*Note: λ_i is the component loading to an indicator and $var(\epsilon_i) = 1 - \lambda_i^2$

Table 3b. Composite Reliability and Average Variance Extracted for Model 2

Constructs	CR	AVE	Formula
Perception	0.9256	0.7581	$CR = (\sum\lambda_i)^2 / [(\sum\lambda_i)^2 + \sum_i var(\epsilon_i)]$
Service Quality (Overall assessment)	-	-	$AVE = \sum\lambda_i^2 / [\sum\lambda_i^2 + \sum_i var(\epsilon_i)]$
User Satisfaction	0.9437	0.8935	

*Note: λ_i is the component loading to an indicator and $var(\epsilon_i) = 1 - \lambda_i^2$

Table 3c. Composite Reliability and Average Variance Extracted for Model 3

Constructs	CR	AVE	Formula
Perception (Service Quality)	0.9263	0.7596	$CR = (\sum\lambda_i)^2 / [(\sum\lambda_i)^2 + \sum_i var(\epsilon_i)]$
User Satisfaction	0.9437	0.8935	$AVE = \sum\lambda_i^2 / [\sum\lambda_i^2 + \sum_i var(\epsilon_i)]$

*Note: λ_i is the component loading to an indicator and $var(\epsilon_i) = 1 - \lambda_i^2$

Table 4a. Correlations of latent variables for Model 1

	Service Quality	User Satisfaction
Service Quality (Disconfirmation)	(0.886)	
User Satisfaction	0.455	(0.945)

*Note: the number in parenthesis is the square root of AVE

Table 4a. Correlations of latent variables for Model 2

	Perception	Service Quality	User Satisfaction
Perception	(0.871)		
Service Quality (Overall assessment)	0.831	(1.000)	
User Satisfaction	0.648	0.649	(0.945)

*Note: the number in parenthesis is the square root of AVE

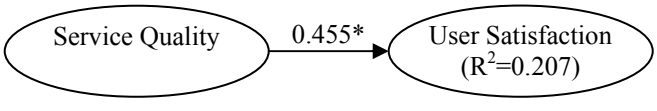
Table 4a. Correlations of latent variables for Model 3

	Perception	User Satisfaction
Perception (Service Quality)	(0.872)	
User Satisfaction	0.650	(0.945)

This indicates that there exists reasonable discriminant validity among all of the constructs except the correlation between perception and service quality in Model 2. This may explain that the perceived overall evaluation of the service quality is a higher abstraction of service quality. Accordingly, the correlation between perception and service quality in Model 2 is expected to be high. However, it should not be so high as to preclude it from being considered a separate construct. As noted above, it does satisfy the discriminant validity criteria, whereby the diagonal of the correlation matrix is greater than the off-diagonal correlations.

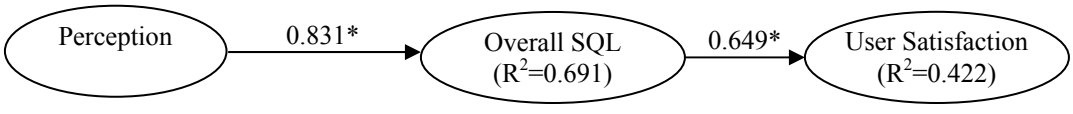
Assessment of the Structural Model

The path coefficients in the PLS model represent standardized regression coefficients. The suggested lower limit of substantive significance for regression coefficients is 0.05 (Pedhazur 1997). In a more conservative position, path coefficients of 0.10 and above are preferable. As shown in Figure 2a, b, and c, all path coefficients are over 0.1 satisfying both conservative criteria and the suggested lower limit and also qualitatively significant at $p < 0.001$.



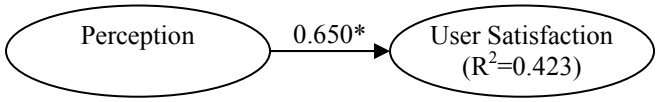
* p <.001 (based on $t_{(130)}$, two-tailed test)

Figure 2a. Structural Assessment for Service Quality-User Satisfaction (Model 1)



* p <.001 (based on $t_{(130)}$, two-tailed test)

Figure 2b. Structural Assessment for Perception-Overall Service Quality-User Satisfaction (Model 2)



* p <.001 (based on $t_{(130)}$, two-tailed test)

Figure 2c. Structural Assessment for Perception-Only-User Satisfaction (Model 3)

Both overall assessment of service quality and perception-only construct explain more variance in user satisfaction than gap score-based service quality. That is, the variance in user satisfaction is explained about 42% by overall assessment and perception-only of service quality, increased by 21%. This result seems to confirm the argument that an aggregate level of measurement or perception-based service quality is more effective than an attribute level of measurement (Teas 1993; Teas 1994; Van Dyke, Prybutok, and Kappelman 1999).

DISCUSSION AND IMPLICATIONS

The structural assessment results indicate that service quality affects user satisfaction positively in all cases of service quality conceptualization. Model 1 explains about 21% of the variation in user satisfaction (R^2 = 0.207), which is quite lower than those of Model 2 (0.422) and Model 3 (0.423), while all the paths in the model are statistically significant ($p < 0.001$). The results indicate that service quality (gap score-based) is positively associated with user satisfaction. That is, as service quality increases, user satisfaction gets better because, in the sample company, actual IS services provided have exceeded users' expectation. This finding is consistent with the previous research in SERVQUAL (Kettinger and Lee 1994; Lam and Woo 1997; Pitt, Watson, and Kavan 1995; Watson, Pitt, and Kavan 1998). IS users are expected to have high expectation (reference to an ideal service provider) towards their own IS service. That is, as clients' perception of IS service increases, disconfirmation decreases (since expectation is expected to increase more in magnitude), while as client's expectation increases, disconfirmation increases.

Model 2 shows that overall assessment of service quality explains about 42% of the variation in user satisfaction (R^2 = 0.422), which is a substantial improvement of its predictive power. In addition, perception explains about 69% of the variation in overall assessment of IS service quality (R^2 = 0.691). All the paths in the model are statistically significant ($p < 0.001$). The high correlation between perception and overall assessment of service quality may indicate that the overall assessment of service quality could be a higher order construct of perception of service quality. However, given the discriminant validity between perception and overall service quality (consult table 3b), a single-item overall measure of IS service quality is distinct and should not be considered the same as a multiple-level measure (Galletta and Lederer 1989; Szymanski and Henard 2001). Overall service quality is positively associated with user satisfaction, as expected. In addition, service quality (gap score-based), different in Van Dyke and his colleagues (Van Dyke, Prybutok, and Kappelman 1999) where service quality is associated with user satisfaction than with overall service quality, is related with overall service quality more than with user satisfaction.

Model 3 explains about the same variation (42%) in user satisfaction (R^2 = 0.423, $p < 0.001$) as Model 2. The path in the model is statistically significant ($p < 0.001$). This result may provide some evidence for the argument that perception entails expectation in its complex psychological evaluative process or expectation may be an antecedent to perception as suggested by Boulding, Kalra, Staelin, and Zeithaml (1993).

To summarize, in terms of the predictive power of the models, Models 2 and 3 (overall assessment and perception-only) explain more variation in user satisfaction than Model 1 (confirmation/disconfirmation) does, although all three service quality constructs

appear to have a positive effect on user satisfaction. Overall assessment of service quality appears to mediate the effect of perception based service quality to user satisfaction.

CONCLUDING REMARKS

This study presents an overview picture of comparing different structural models of IS service quality and the relationship between service quality and user satisfaction. To this end, we focus on the role of service quality in predicting user satisfaction and that of perception in shaping the service quality perception, instead of analyzing the dimensionality of service quality.

Although all three ways of measuring service quality appear to be statistically significant, perception only and overall assessment of service quality seem to be better than the confirmation/disconfirmation perspective. The possible answers for this result may be that the aggregate level of measurement better reflects the complex cognitive process of individual users in evaluating IS service quality (Galletta and Lederer 1989; Szymanski and Henard 2001), and the perception measures of IS service quality as an attitude measurement outperform the confirmation/disconfirmation measures as an attitude formation process measurement (Cronin and Taylor 1994). However, the findings of this research do not renounce the usefulness of SERVQUAL instrument of providing directions to IT managers by evaluating the gaps in IS service quality (Parasuraman 2002; Parasuraman, Zeithaml, and Berry 1988; Parasuraman, Zeithaml, and Berry 1994; Pitt, Watson, and Kavan 1995; Watson, Pitt, and Kavan 1998). A lot of previous studies have shown that SERVQUAL perspective can be applicable to use for the purposes of providing IS managers with useful directions for managing their departments (Jiang, Klein, and Carr 2002; Jiang, Klein, and Crampton 2000; Kettinger and Lee 1994; Kettinger and Lee 1997; Watson, Pitt, and Kavan 1998).

The findings of this research imply that when managers assess service quality to improve their IS service quality, they have to be cautious in ruling out or selecting one way or another of measuring service quality. Although this study shows that perception-only measure and overall assessment measure better predict user satisfaction, the usefulness of confirmation/disconfirmation cannot be ignored in assessing the current service offerings of an IS department. In particular, the overall evaluation of IS service quality as well as attribute level aspects of IS service should be taken into account when assessing IS service. The current study also shows that mangers have to take care of the service quality to enhance user satisfaction. For academics, the findings of the current study give rise to the issues of measurement development to assess the service quality of IS department or the service quality in the context of electronic commerce and call for further research on the role of expectation in shaping the service quality perception.

This study is not free from limitations. The small sample size and the limited source of samples (a manufacturing company) restrict the generalization of the findings of this research. Future research is recommended to collect data across the industries to secure more generalizability. Data separately collected for perception-only measures may also give more power in the comparison of the models. The simplified user satisfaction measures are another limitation. Future research should use the full measures of user satisfaction such as user information satisfaction and end-user computing satisfaction (e.g., Bailey and Pearson 1983; Baroudi and Orlikowski 1988; DeLone and McLean 1992; Doll, Raghunathan, Lim, and Gupta 1995; Doll, Xia, and Torkzadeh 1994; Garrity and Sanders 1998; Ives, Olson, and Baroudi 1983; Melone 1990) and gather more data from various organizations.

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APPENDIX: CONFIRMATORY FACTOR ANALYSIS RESULTS

A1. Correlations of the Four Subdimensions of Service Quality Construct

	Reliability	Responsiveness	Assurance	Empathy
Reliability	1.00			
Responsiveness	0.947	1.00		
Assurance	0.777	0.835	1.00	
Empathy	0.784	0.841	0.961	1.00

A2. Correlations of the Four Subdimensions of Perception-Only Construct

	Reliability	Responsiveness	Assurance	Empathy
Reliability	1.00			
Responsiveness	0.921	1.00		
Assurance	0.734	0.915	1.00	
Empathy	0.820	0.935	0.918	1.00

A3. Discriminant Validity Test via Chi-Square Change (Service Quality Construct)

	χ^2	$\Delta\chi^2$	d.f.	CFI	NFI	RFI
Original Five Dimensions	276.1	-	129	0.927	0.873	0.832
Reliability - Responsiveness	295.9	19.8***	130	0.917	0.864	0.821
Reliability - Assurance	368.9	92.8***	130	0.881	0.830	0.777
Reliability - Empathy	388.4	112.3***	130	0.871	0.821	0.765
Responsiveness - Assurance	337.6	61.5***	130	0.896	0.845	0.796
Responsiveness - Empathy	349.6	73.5***	130	0.890	0.839	0.789
Assurance - Empathy	282.4	6.3*	130	0.924	0.870	0.829

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A4. Discriminant Validity Test via Chi-Square Change (Perception-Only Construct)

	χ^2	$\Delta\chi^2$	d.f.	CFI	NFI	RFI
Original Five Dimensions	226.2	-	129	0.974	0.942	0.974
Reliability - Responsiveness	240.2	14.0***	130	0.971	0.930	0.920
Reliability - Assurance	300.3	74.1***	130	0.955	0.924	0.900
Reliability - Empathy	277.9	51.7***	130	0.961	0.929	0.907
Responsiveness - Assurance	236.9	10.7**	130	0.972	0.940	0.921
Responsiveness - Empathy	233.8	7.6*	130	0.972	0.941	0.922
Assurance - Empathy	237.1	10.9***	130	0.972	0.940	0.921

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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