System Development Service Quality: Measurement Development and Validation

Man Kit Chang[1], Louisa Liu[2]

[1] Department of Finance and Decision Sciences, Hong Kong Baptist University
(mkchang@hkbu.edu.hk)
[2] Manulife (International) Limited
(luilouisa@yahoo.com)

Abstract

In recent years, IS researchers have become increasingly interested in service quality of information system functions. However, one area that receives little attention is the service quality of the information system development process. The current study attempts to fill this gap by developing an instrument to measure the system development service quality (ISDEV-SERVPERF) and to test the validity of the newly developed instrument by placing it into a nomological network developed based on the DeLone and McLean's [13] model of IS success.

Through mail survey, data were collected from 168 users of information systems who have been involved in system development. Confirmatory factor analysis and structural path analysis using LISREL were performed to analyze the data collected. ISDEV-SERVPERF is found to be a valid and the reliable measure of system development service quality. A second-order factor structure with the system development service quality as the second-order factor and reliability, responsiveness, assurance and empathy as first-order factors is found to provide a good fit to the data. The system development service quality has also been found to have significant positive effects on various measures of IS success. By conceptualizing system development as a service delivery process, it provides a new theoretical perspective in studying the impacts of system development process. Moreover, the newly developed measurement scales, ISDEV-SERVPERF, can be used in future study of service quality of system development or as a diagnostic device for practical purpose.

1. Introduction

The shift from goods-based economy to a service-based economy in a macro level [44] and the growing significance of the service components of information system functions in particular [20] have been recognized by IS researchers. In recent years, IS researchers have become increasingly interested in service quality of information system functions. There is large body of literature on this topic that has been published. Some of them examine the conceptual and measurement aspects of IS service quality [23,24,42,50,51,53], while other investigate the importance of service quality of the information system functions to an organization. Relationships between IS service quality with such variables as user satisfaction with the IS, trust in the IS department, and satisfaction with the IS department have been studied [8,16,19,20,25,26,30,36,41]. In general, these studies found the concept of service quality useful and important to user satisfaction and system success. These studies focus primarily on the service quality of IS functions as a whole and the supports provided by the IS personnel during the operations of information systems. Surprisingly, there is paucity of research that examines the information system development process from the perspective of service quality.

We would argue that a major portion of the system development process is actually services provided by the system developers and process possesses the essential characteristics of service - intangibility, heterogeneity, and inseparability [4,32,49]. As such, service quality provides a useful theoretical lens to understand what can be done to improve the process. Although researchers have investigated the impacts of different aspects of the system development process, such as user involvement and participation [33,45], user-developer communication [18,35] and developer's responsiveness [14], on the success of information systems, using service quality concept allows us to more holistic understanding of the quality of system development process. Service quality is measured with such dimensions as responsiveness, reliability, and assurance. These dimensions cover important aspects of the system development process that have been investigated separately in previous studies.

In order to investigate the service quality of the system development process, the current study attempts to develop a measure of the construct based on the widely used SERVQUAL instrument [40]. To test the validity of the newly developed instrument, a nomological network was developed mainly based on the DeLone and McLean's [12,13] IS success model.

2. Background and Literature Review

2.1 System Development as a Service Delivery Process

Services are fundamentally different from physical goods. Services are not things; they are processes. Researchers suggest that service has the characteristics of intangibility, heterogeneity, and inseparability [4,32]. Intangibility means that service, rather than as an object, is a performance and experience. Heterogeneity indicates that the performance of service varies from producer to producer, from customer to customer, and from time to time. Inseparability means that the production and consumption of service take place at the same time. Thus, the quality of service occurs during the service delivery, that is, in the interaction between the customer and the service performer.

Information systems development can be treated as a process of collective action involving many different organizational actors including managers, users, and system developers. Extensive interactions amongst these actors are required. The development process can be basically divided into the Study stage, the Design stage, and the Programming, Testing and Implementation stage. The aim of these activities is to produce the final information systems that the can satisfy the needs of the users so that the systems will be used. A lot of interactions among system developers and users are required in order to produce the deliverables in each stage. System developers are actually providing service to the users during system development process since the exchanges between the developers and the users exhibit the characteristics of services.

For example, in the Study stage, both the users and the developers need to involve in the process in order to get the correct user requirements of the system, as well as establish the feasibility of the project. In order to achieve these, system analysts need to interview the users and produce the user requirement specifications. Different system analysts have their own knowledge, skills, and style. They may interact with users differently. Even the same analyst may perform differently at different time. Thus, as can be seen from the foregoing discussion, the task of requirement acquisition does have the characteristics of service, i.e., intangibility, heterogeneity, inseparability, and direct human interaction. Similar analysis can be applied to other system development stages.

Therefore, in order to produce a high quality information system, system developers must be empathetic of the needs of the users, as well as responsive to the requests of the users during the development process. These analyses lead us to conclude that if we want to understand how we can produce successful information systems, it will be fruitful to analyze the system development process from the perspective of service and service quality.

2.2 Service Quality and IS

Service quality can be defined as a global judgment of attitude relating to the superiority or excellence of service. The perception of service quality results from the comparison of expectations with performance [39]. The most widely known scale for measuring service quality is SERVQUAL developed by Parasuraman et al. [40]. Although SERVQUAL is not without its criticisms, it has been used in a large number of studies and applied to wide variety of areas. IS researchers have also adopted it in variety of settings. Thus, the current study used it as the basis for developing the measures for the system development service quality.

SERVQUAL contains 22 paired-items to measure 5 dimensions. They are reliability, responsiveness, empathy, assurance, and tangibles. Based on the expectancy-disconfirmation paradigm, perceived service quality involved a comparison of customer expectations with customer perceptions of actual service performance. In SERVQUAL, the expectation score is subtracted from the perceptions score to create such a "gap" measure of service quality [51].

The generalizability and stability of the five dimensions of SERVQUAL across different service settings has been questioned by a number of researchers [7,11,22]. In the information systems area, Kettinger & Lee [22] collected SERVQUAL data from users of a college computing services department and using confirmatory factor analysis to confirm the dimensionality. The dimension "tangibles" was dropped because the remaining four-factor model fit the data the best. Jiang et al. [19] reported similar result from a sample of 193 IS users from variety of companies in US. Although dimensions for specific service setting may vary, we believe that SERVQUAL still provides a good framework of what constitutes IS system development service quality. As pointed out by various IS researchers, it is hard to discern any unique features of IS that make the standard SERVQUAL dimensions inappropriate [42,50]. Jiang et al. [19] also concluded that their results lean toward the credibility of the instrument for use in the field for four of the five SERVQUAL dimensions. However, the dimension of tangibles seems to be quite problematic; caution will be

taken to test the dimensionality of the instrument. The first and second-order factor structure will also be explored in this study.

The appropriateness of using the gap score to measure service quality when using SERVQUAL has also been widely debated. Some researchers maintained that there was not much theoretical or empirical evidence supported the relevance of the expectations-performance gap as the basis for measuring service quality [7,50]. Responding to this shortcoming of "gap" operationalization, a performance-based alternative to the SERVQUAL measure, SERVPERF, was developed and tested [10]. In SERVPERF, the items are the same as SERVQUAL, but respondents are required to only rate the actual performance of the service received. It had been found that the performance-only scores obtained higher convergent and predictive validity than the "gap" scores [3,6,26,42].

Because the objective of our study is to see the impacts of services quality of IS system development on various other variables and the performance-only method of measurement of service quality possesses better psychometric properties, the performance-only measure was used in the current study.

3. Research Model

In order to test the validity and the impact of systems development service quality, we place the new construct into a nomological network based on the IS success model proposed by DeLone and McLean (D&M) [12,13] and Seddon's re-specification of the D&M's model.

DeLone and McLean [12], after reviewing over 180 articles on system success, introduced a comprehensive taxonomy which posits six major dimensions of IS success – System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. They have also proposed an IS success model linking the six dimensions of IS success. Ten years later, they refined their model by adding service quality and intention to the model; while at the same time they collapsed the individual impact and organizational impact into one net benefit construct [13]. In this model, Use or Intention to Use and User

Satisfaction is affected by System Quality, Information Quality, and Service Quality. User Satisfaction may be affected by Use positively or negatively, as well as the reverse being true. Use and User Satisfaction lead to the realization of Net Benefits, while the Net Benefit will then affect the Use and Satisfaction.

Based on a number of studies that attempted to validate original D&M model, Seddon [47] concluded that there is conceptual difficulty in D&M's model because it combines both process and variance models. The construct "Use" in the model actually has three meanings and the meaning shifts in different parts of the model. Seddon re-specified D&M's model into a pure variance model. Part of the model that is relevant to the current study is shown in Figure 1.

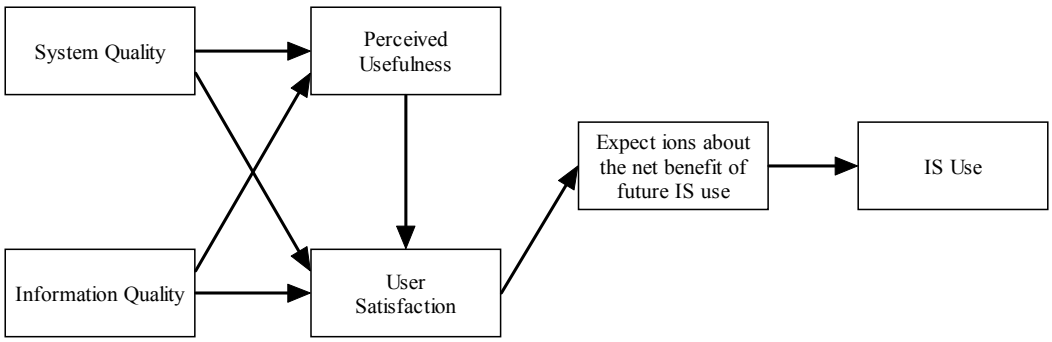

Figure 1 Part of Seddon's Model of IS Success

In the respecified model, System Quality and Information Quality are the antecedents of Perceived Usefulness (replacing the place of Net Benefit) and User Satisfaction, while Perceived Usefulness is also an antecedent of User Satisfaction. The updated D&M model has incorporate some of the idea from Seddon's respecification.

Perceived Usefulness in the model is defined as "the degree to which the stakeholder believes that using a particular system has enhanced his or her job performance, or his or her group's or organization's performance." [47, p.246]. This is the same definition used in the Technology Acceptance Model (TAM). User Satisfaction refers to the subjective evaluation of the various consequences of using the information systems evaluated on a pleasant-unpleasant continuum [47]. System Quality is concerned with whether or not there are "bugs" in the system, the consistency of the user

interface, ease of use, and quality of documentation [47]. Large part of this definition of system quality, such as consistency of interface and good documentation, is concerned with whether users can use information systems with minimum effort and difficulties. This is very similar to the concept of perceived ease of use in TAM. In fact, a number of previous studies has used ease of use to measure system quality [27,29,43]. Information Quality represents the measure of information system output in such area as relevance, timeliness and accuracy [13,47]. It has been argued that Seddon's model is more in line with the TAM and theory of planned behavior's belief-attitude-behavior framework [43]. Thus, we have adopted the Seddon's respecification of D&M's model (hereafter cited as D-M-S model) in this study to test the validity and the impacts of system development service quality.

Seddon's model does not include the factor Service Quality of IS department or staffs. On the other hand, DeLone and McLean [13] have included Information System Service Quality as an antecedent of Use and User Satisfaction in their updated model because they believe that service quality may be the most important quality component to measure the overall success of IS departments. The IS service quality construct in the updated D&M model refers to the service quality of the IS department; on the other hand, we will replace the service quality of the IS department with system development service quality which assess the services provided by the system developers in system development process.

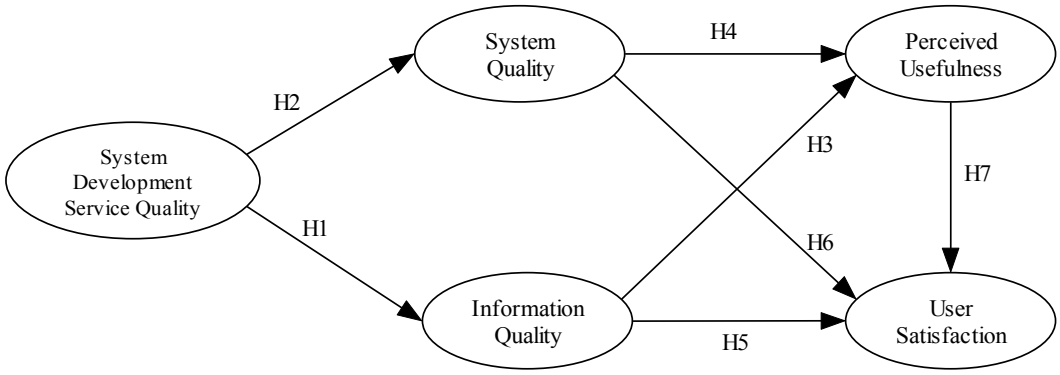

Figure 2 Nomological Net of System Development Service Quality

Our nomological network is shown in Figure 2. System development service quality is included as the antecedent of information quality and system quality. Service quality in general and service quality of IS functions in particular affect the customer and user satisfaction [30,31,41]. In this study, no direct path is modeled from system development service quality to user satisfaction as specified by the updated D&M model. We postulated that the effect of system development service quality on user satisfaction will be mediated by the system quality and information quality. Service quality in the D&M's model refers to the users' assessment when they are using the system, thus this assessment may have immediate and direct impact on user satisfaction. However, system development service quality refers to the assessment of service quality of the IS developers during the period of system development that may be a bit remote from the time of the actual use of the information systems. Thus we would postulate that the effect of system development service quality on perceived usefulness and user satisfaction will be mediated by the information quality and system quality.

To the best of our knowledge, there is no other study investigating system development service quality, so related studies will be used to inform the formulation of the following hypotheses. As pointed out by Newman and Robey [37], the quality of resultant system is generally assumed to be affected by the development of information system process. McKeen et al. [35] investigated 151 system development projects and found that the quality of developer-user communication has a positive effect on user information satisfaction. The measurement of user information satisfaction is similar to information quality. Both of them are concerned with the relevancy and accuracy of the system output. Based on these findings, it was hypothesized that:

H1: System development service quality is positively related to information quality.

More empathetic to the needs of the users and more responsive to the requests of the users may also lead to a better design of the system. In studying the adoption of an expert system using an extended TAM, Gefen and Keil [14] have found that developer responsiveness has positive effect on perceived ease of use of the final system. Since responsiveness is one aspect of system development service quality and ease of use has been used to operationalize system quality, the current research model posited that:

H2: System development service quality is positively related to system quality.

The remaining hypotheses of the model, thus the relationships between information quality, system quality, perceived usefulness, and user satisfaction, are developed based on the D-M-S model. DeLone and McLean's [13] articles has cited empirical studies that support (to various degree) the relationships in the model. Moreover, it can be said that the relationships are largely validated by empirical results of recent studies [1,27,29,55]. However, some recent studies did find some insignificant result that may require further validation. Sabherwal et al. [46] in a meta-analysis of 121 studies on information system success, has found that perceived usefulness did not have significant effect on user satisfaction. They contended that this may be due to the inclusion of some common factors, like user attitude toward IS in general; thus, they suggested that the model of the IS success may need to be modified if contextual antecedents of IS success are incorporated. When leadership and incentive were included as contextual factors that affect success variables, Kulkarni et al. [27] have found that knowledge content quality and system quality did not have significant effect on perceived usefulness. Moreover, in the context of knowledge management system success and library information system, system quality is found to have no influence on perceived usefulness [29,55]. It was suggested that the insignificant relationship may be due to the prominent importance placed on the information quality by the users of such systems [55]. With these exceptions in mind, the following hypotheses were proposed according the D-M-S model and the empirical results that support the model:

H3: Information Quality is positively related to Perceived Usefulness.

H4: System Quality is positively related to Perceived Usefulness.

H5: Information Quality is positively related to User Satisfaction.

H6: System Quality is positively related to User Satisfaction.

H7: Perceived Usefulness is positively related to User Satisfaction.

4. Method

4.1 Operationalization of the System Development Service Quality Construct

In the current study, SERVPERF was adopted and modified to measure the perceived service quality of the whole information system development process. The 22 items of SERVPERF were carefully scrutinized for their suitability of measuring system development service quality. Decisions of refining the scale were also based on previous IS studies on the refinement of SERVPERF. Three items were removed from the original instrument. The removed items are: "Materials associated with the services (such as pamphlets or statements) are visually appealing at XYZ", "You feel safe in your transactions with XYZ", and "XYZ has operating hours convenient to all its customers". The reason of dropping these items is that when considering the service provided in the IS development process, the content of the items seems not applicable. Moreover, these items have been removed in Kettinger and Lee's [23] study to obtain a more valid scale. Therefore, the resultant measurement of system development service quality, which will be called ISDEV-SERVPERF, contains 19 items covering the five dimensions of responsiveness, reliability, assurance, empathy and tangibles.

The wordings of the 19 items was slightly modified to fit the context of IS development. For example, the statement of "when XYZ promises to do something by a certain time, it does so." in the original SERVQUAL was modified to "when IT/IS staff promised to do something in the system development process within a certain time, they did so."

Performance-only rating of service was used in the current study in order to avoid the psychometric problem of the "gap" score. Since this study attempts to investigate the impacts of service quality on various measures of system

success, the predictive validity of the scales is important. That is the reason why we decided to use the performance-only measure.

4.2 Measure for other Constructs in the Theoretical Model

Information Quality: The measurement scale of information quality was adopted from Kettinger and Lee (1994). This scale contains 4 items, asking the respondents about the quality of the information provided by the resultant system, including the accuracy and the timeliness of the information.

System Quality: Consistent with previous studies using D&M and Seddon's models, system quality was adapted from ease of use [27,29,43]. Four items were adapted to measure this construct [14,52]. For example, respondents were asked "I would find it easy to use the system to do what I what to do".

Perceived Usefulness: The measurement scale for perceived usefulness was adopted from Gefen and Keil [14] and Venkatesh and Davis [52]. There were five items used to measure this construct, asking the respondents about such thing as whether the system improves their job productivity or effectiveness

User Satisfaction: A 3-item scale similar to other studies is used to measure the overall user satisfaction [29,43]. The respondents were asked how satisfy they are with the resultant system. For example, item likes "How would you rate your overall satisfaction of the system?" was used. A 7-point Likert scale ranging from very dissatisfied (1) to very satisfied (7) was used in this study.

4.3 Questionnaire Design

The questionnaire is divided into three parts. Part one asked the respondents to identify a particular system that he/she has been involved in the system development process and has used it in their job. The respondents were requested to answer all the questions that follow in the questionnaire by referencing to this particular system they identified. Part two consists of the items measuring system development service quality, information quality, system quality, perceived usefulness, and overall user satisfaction. Finally, in part three, the demographic data of respondents are collected. The information collected includes gender, age, educational qualification, position in company, and what industry the respondents are working in.

This questionnaire was piloted test with 25 information systems' users who have participated in the system development process. The questionnaire was adjusted according to their comments.

4.4 Sample and Data Collection Procedure

The sample of interest of this study is users of information system who have also involved in the system development process. We have chosen these respondents because they can provide valid information concerning both the system development process and the quality of the final system.

A number of steps have been carried out to identify such group of respondents. First, companies were selected from the Directory of Key Decision-Makers in Hong Kong Businesses based on the criteria that the number of employee located in Hong Kong is greater than 100 and there is an IT department. Second, direct phone conversations with the IT department representatives were made, introducing the study's objectives and inviting appropriate candidates of their company to participate in this study. The reason of contacting the IT department representative is that they are the people who know which employees of their company have participated in system development and have been using the system. After receiving the cooperation of IT department representatives, sets of questionnaire, cover letter explaining the purpose of the study, and return envelop were mailed to the IT department representatives. The IT department representatives would then transfer the materials to the appropriate respondents. Two weeks after the questionnaires were sent follow-up call was made to the IT representative. As direct follow-up to the potential respondents was not possible, this may affect the response rate of this study.

Totally 655 questionnaires were sent to 182 companies. Finally, 168 usable questionnaires were returned yielding an effective response rate of 25.6%. Among the respondents, 58.9% of them were male. Regarding their age, 69.1%, of the respondents belonged to the age group of 20-29, 26.1% belonged to the age group of 30-39, with the remaining 4.8% belonged to the age group of 40-49. Most of the respondents, around 80%, have an education attainment of polytechnic diploma or above.

5. Analysis and Results

The data were analyzed using the two-step approach as suggested by Anderson and Gerbing [2]. In the first step, a confirmatory factor analysis (CFA) was performed to determine whether the measured variables reliably reflect the hypothesized latent variables. Any problem of the measurement was resolved at this stage and measurement model re-specified. In this step, the factor structure, validity, and reliability of the ISDEV-SERVPERF scale were assessed first. It was followed by the assessment of the validity and reliability of all constructs in the research model together. Convergent validity was assessed based on the criteria that the indicator's estimated pattern coefficient is significant on its posited underlying construct factor, composite reliability is higher than 0.7, and the average variance extracted (AVE) is higher than 0.5. Discriminant validity was assessed by constraining the correlation parameters between constructs to 1.0. A significant lower χ^2 value of the unconstrained model suggests the achievement of discriminant validity [15]. In the second step, the proposed structural path model of the research model was tested.

The statistical program LISREL 8.8 was used to perform the structural modeling analysis. Model fit was evaluated using the Comparative Fit Index (CFI), RMSEA, and χ^2/df as suggested by Hair et al. [17] on the choice of fit indices. The desirable value of CFI is greater than 0.95 and RMSEA less than 0.08, and the χ^2/df should have a value less than three [17].

5.1 Confirmatory Factor Analysis of the ISDEV-SERVPERF Scale

The 19-item ISDEV-SERVPERF used to measure the system development service quality process was subjected to confirmatory factor analysis. First, the first-order factor structure having the five dimensions of ISDEV-SERVPERF as the latent factors was assessed. The factor variances were fixed at unity and all latent factors were allowed to correlate freely. The parameters were estimated using the maximum likelihood method.

The results are shown in Table 1 and Table 2. As shown in the second row of Table 1, the five-factor first-order model did provide an adequate fit to the data. However, analyzing the factor loadings of individual constructs showed that the factor loading of the items, the composite reliability, and the AVE of the tangibles dimension were quite low. Since past studies have also found that the measurement scale of tangibles has demonstrated low reliability and has to be removed when applied to different areas [22,28,41], it was decided that the 3 items measuring the tangibles dimension be removed and the revised four-factor first-order model was subject to another CFA.

Table 1 Summary Results of Confirmatory Factor Analyses for the Proposed Factor Structures of System Development Service Quality

	χ^2	*df*	*RMSEA*	*CFI*	χ^2/*df*
Model with five basic dimensions of ISDEV-SERVPERF as first order factors (Five-Factor First-Order Model)	327.00	142	0.088	0.97	2.3
Model with four dimensions (tangibles removed) of ISDEV-SERVPERF as first order factors (Revised Four-Factor First-order Model)	211.60	98	0.084	0.98	2.16
Model with system development service quality as a second-order factor to the four dimensions (tangibles removed) of ISDEV-SERVPERF (Second-order Model)	212.99	100	0.083	0.98	2.13

Table 2 Standardized Confirmatory Factor Loadings of ISDEV-SERVPERF for First-order Models

	5-Factor Model			4-Factor Model		
Factor	**Composite Reliability**	**AVE**	**Factor Loadings***	**Composite Reliability**	**AVE**	**Factor Loadings***
Reliability	0.90	0.65		0.90	0.65	
REL1 #			0.76			0.76
REL2			0.83			0.83
REL3			0.85			0.85
REL4			0.79			0.79
REL5			0.80			0.80
Responsiveness	0.90	0.67		0.90	0.67	
RES1			0.81			0.81
RES2			0.87			0.87
RES3			0.77			0.77
RES4			0.88			0.88
Empathy	0.89	0.69		0.89	0.68	
EMP1			0.84			0.84
EMP2			0.79			0.78
EMP3			0.85			0.85
EMP4			0.83			0.83
Assurance	0.89	0.75		0.90	0.75	
ASSU1			0.87			0.87
ASSU2			0.83			0.83
ASSU3			0.89			0.89
Tangibles	0.54	0.28				
TAN1			0.43			
TAN2			0.61			
TAN3			0.54			

* All factor loadings are significant at alpha level of 0.01

The abbreviation refers to the questions shown in Appendix A

The 4-factor first-order model of the remaining 16 items resulted in an adequate fit as shown in third row of Table 1. Column 7 of the Table 2 shows the factor loadings for this revised model. All factor loadings were fairly high and were significant. Combined with the high composite reliability and AVE, these results supported the convergent validity of the measurement scales [2]. These results suggest that the four dimensions of ISDEV-SERVPERF, i.e., reliability, responsiveness, empathy, and assurance, are reliable measure of system development service quality.

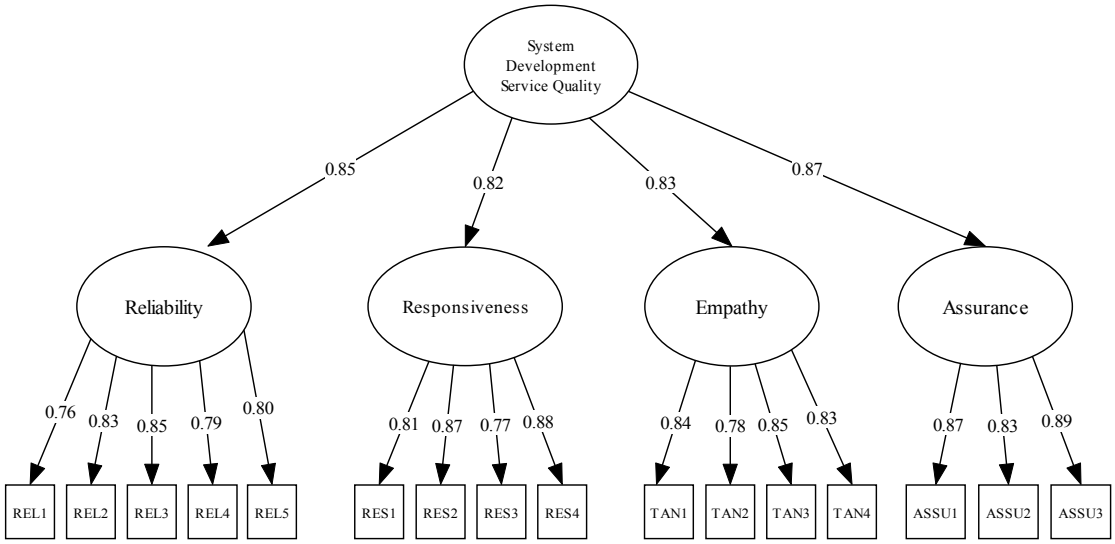

Figure 3 Second-Order Factor Structure of System Development Service Quality

The next step was to determine if system development service quality could be modeled as a second order factor to the dimensions identified in first order CFA as found in order study on IS service quality [8,19,28]. Using the same 16 items for the four dimensions as before (that is, exclude the "tangibles" dimension), system development service quality was modeled as a second-order factor (as shown in Figure 3). As shown in the fourth row of Table 1, the second-order factor model provided an adequate fit to the data. Since the fit statistics were almost identical for the first- and second-order models, second-order model should be accepted as it is more parsimonious [9,48]. As suggested by Anderson and Gerbing [2], in order to support the appropriateness of the second-order model, the gamma coefficient, which is the factor loadings of the first-order factors on the second-order factor, should be high and significant. The gamma value, and the composite reliability as well as the AVE of the first order factors are shown in Table 3. As shown, all the gamma values were very high and significant, thus it supports the convergent validity of the first-order factors to the second-order factor. This suggested that the users evaluate the service quality of system development on the confirmed four dimensions, but they also viewed overall system development service quality as a higher order factor that captured a meaning common to all the dimensions.

5.2 CFA for all Constructs in the Research Model

The CFA model of all 8 first order factors including the four dimensions of system development service quality, information quality, system quality, perceived usefulness, and user satisfaction resulted in a fairly good data fit (χ^2 = 733.60, df = 436, CFI = 0.98, χ^2/df=1.68, RMSEA = 0.062). Table 4 shows the measurement properties of all eight constructs. All the factor loadings were fairly high and were significant . Moreover, all construct reliabilities were much higher than the acceptable level of 0.7 and AVE higher than 0.5. This supported the convergent validity of the measurement of each construct.

Discriminant validity of the constructs in the model was assessed by constraining the correlation parameter between two constructs to 1.0, one pair of constructs at a time. Discriminant validity is achieved if a significantly lower χ^2 value of the unconstrained model can be obtained. Chi-square difference test was used to test whether the χ^2 values of the constrained and unconstrained model were significantly different. The difference in χ^2 between the two models is also a χ^2 variate with degrees of freedom equal to one [5]. With significant level at 0.01 and the degrees of freedom equal to 1, the critical value of this chi-square difference test is 3.84. The values of the chi-square difference range from 74.95 to 464.09. All the chi-square differences were significant, which suggested that each measurement scale captured a construct that was significantly unique from other constructs, and this provided evidence of discriminant validity [48].

Table 3 Results of Second-order CFA of ISDEV-SERVPERF

Factor	Gamma*	Construct Reliability	AVE
Reliability	0.85	0.90	0.65
Responsiveness	0.82	0.90	0.67
Empathy	0.83	0.89	0.68
Assurance	0.87	0.90	0.75

*All gamma coefficients are significant at 0.01.

Table 4 Standardized Factor Loadings for the CFA Model of the Theoretical Model

Factor	C. R.^	AVE	Factor Loading*	Factor	C. R.	AVE	Factor Loading*
Perceived Usefulness	0.94	0.74		**Reliability**	0.90	0.65	
PU1			0.89	REL1			0.76
PU2			0.86	REL2			0.82
PU3			0.91	REL3			0.85
PU4			0.90	REL4			0.79
PU5			0.75	REL5			0.81
Information Quality	0.91	0.71		**Responsiveness**	0.90	0.70	
IQ1			0.84	RES1			0.81
IQ2			0.89	RES2			0.87
IQ3			0.83	RES3			0.77
IQ4			0.82	RES4			0.89
System Quality	0.93	0.77		**Empathy**	0.89	0.69	
SysQ1			0.88	EMP1			0.84
SysQ2			0.87	EMP2			0.79
SysQ3			0.88	EMP3			0.85
SysQ4			0.89	EMP4			0.83
User Satisfaction	0.94	0.84		**Assurance**	0.90	0.75	
USAT1			0.92	ASSU1			0.89
USAT2			0.92	ASSU2			0.82
USAT3			0.91	ASSU3			0.88

* All factor loadings are significant at alpha level of 0.01

^ C. R. stands for composite reliability

The abbreviation refers to the questions shown in Appendix A

5.3 Analysis for the Structural Path Model

To test the nomological validity of system development service quality, the proposed research model was tested here via the structural path model as shown in Figure 4. To avoid clustering the figure, the indicators of the constructs and the first level factors of ISDEV-SERVPERF are not shown. The fit statistics suggested that the model provided a good fit to the data (χ^2 = 818.9, df = 453, CFI = 0.98, χ^2/df =1.81, RMSEA=0.062).

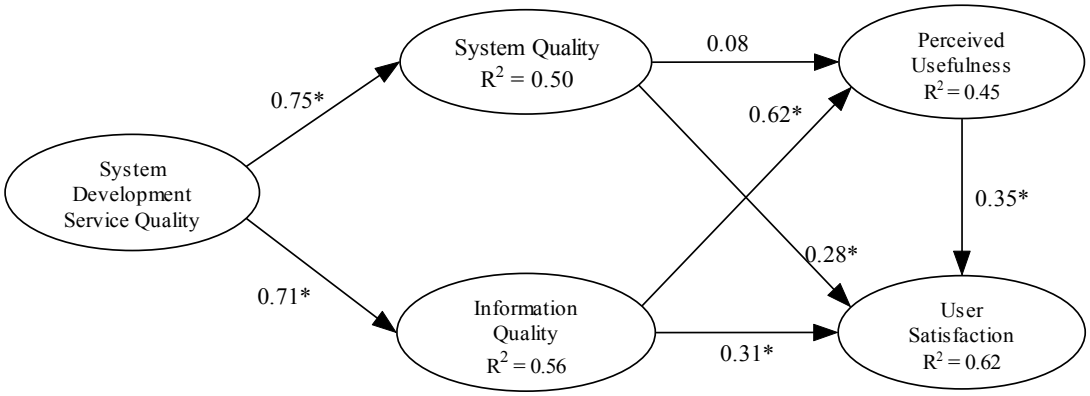

Figure 4 Results of the Analysis for the Research Model

Figure 4 presents the standardized structural path coefficients along the arrows of the proposed research model. The patterns of causal relationships were consistent with those predicted by the research model. Six out of the seven hypotheses were supported.

As shown in the figure, information quality (β = .31), system quality (β = .28), and perceived usefulness (β = .35) were significantly positively related to the user satisfaction of the information systems. Perceived usefulness affects the user satisfaction the most. In all, 62% of the variance of user satisfaction was accounted for. Therefore, the results supported hypotheses H5, H6, and H7.

Looking at the antecedents of perceived usefulness, system quality (β = 0.08) was not significantly related to perceived usefulness, which was contrary to expectation. Therefore, hypothesis H4 was not supported. On the other hand, information quality (β = 0.62) was significantly positively related to perceived usefulness. The regression accounted for 45% of the variance of perceived usefulness. Thus, the hypothesis H3 was supported.

The focus of this study is to conceptualize the system development process as a service process and to explore how the quality of the service affects a number of system success measures. As can be seen from Figure 4, system development service quality was significant positively related to system quality (β = .75) and information quality (β = .71). It accounted for 50% and 56% of the variance of system quality and information quality respectively. The result indicates that system development service quality has quite a large impact on these two system characteristics. That is to say, if system developers give users more personal attention (empathy) and had sufficient knowledge to do the job (assurance), they will have better understanding to what the users really need and are capable of providing them, so that the information produced from the system will be more accurate and relevant to the users and the users will find the quality of the system to be better. Therefore, hypotheses H1 and H2 were supported. These results provide support to the construct validity of system development service quality.

6. Discussion and Conclusion

In recent years, the idea that information system departments are providing services to other members in organizations begins to be widely accepted. However, the past research focus primarily on the service quality of the IS department/functions as a whole and assesses such service quality when the users are using the systems. We conceptualized the system development process as a service delivery process and from the perspective of service quality, we analyze the impacts of the interactions between developers and users on the success of the information systems. We adopted and modified the SERVPERF instrument to create the ISDEV-SERVPERF instrument to measure the system development service quality. The results of our analysis show that the ISDEV-SERVPERF is a

valid and reliable instrument. Moreover, system development service quality has also been demonstrated to be useful in understanding and predicting the success of information systems. Conceptualizing the system development process as service can provide a theoretical device to identify important aspects of the system development process that need to be investigated. Moreover, the dimensions of service quality provide a way of capturing the factors investigated by separated studies. For example, user-developer communication [35], developer's responsiveness [14], user training [21], and developer's expertise [54] are actually different aspects of system development service quality. Thus, service quality provides a more comprehensive evaluation to the system development and its explanation power is higher than considering the factor separately, as shown in the result of this study.

The measurement scale ISDEV-SERVPERF, which is adapted from SERVPERF, is found useful and suitable to measure system development service quality. The results show that ISDEV-SERVPERF demonstrates high construct reliability, and good convergent and discriminant validity. The results also show that four dimensions of the scale are applicable in the system development area. They are reliability, responsiveness, assurance and empathy. However, the dimension of tangibles is problematic. Several studies of SERVQUAL also found that the dimension of tangibles exhibits problems [10,22,34,38,41]. The study of Pitt et al. [41] shows that the reliability of tangibles construct is low. Another study needs to remove the tangibles dimension in order to achieve acceptable model fit [22]. IS researchers have suggested the whole issue of tangibles in an IS environment needs further investigation, and practitioners should be caution on the use of the tangibles dimension. In fact, in the interviews of users and developer to explore service quality factors of system development in the current study, few interviewees have mentioned the importance and the needs of including aspects relating to the dimension of tangibles. Thus, at least for system development service quality, tangibles may not have a role in determining the perception of system development service quality. This supports the need for caution when applying SERVQUAL's tangibles dimension to other area in information system functions.

Another concern in using SERVQUAL is the dimensionality of the scale. Although the dimension can be distinguished in current study, our results support a second-order factor structure for ISDEV-SERVPERF and this result is consistent with other studies on service quality [8,19,22]. This suggests that users evaluate system development service quality on the four dimensions but they also view overall system development service quality that captures a meaning common to all the dimensions [11]. Modeling ISDEV-SERVPERF as a second-order factor structure has the advantage of allowing analysis of system development service quality at overall level (by using the full scale) or factor level (by using items within a given dimension). Analysis of data at these different levels would allow evaluations of overall quality and dimension quality. Thus, managers can use the information to identify which area is problematic, and concentrates resources on improving it [11].

It is important for IT managers to understand the level of service quality of their department and of specific system development effort. They may use ISDEV-SERVPERF to assess the service quality for the system development process. The diagnostic information can be the basis for improvement. If deficiencies are found in specific service dimension, relevant training can be provided to the staffs to upgrade their knowledge and skills.

Like all research, the current study has a number of limitations. This study has collected data from users of information system who have also been involved in the system development of the same system they use. They are the most suitable persons to evaluate the performance of the IT staff during the system development and the quality of the resultant system. However, the downsides of this are a relatively small sample size and the difficulties of making the follow-up action of the survey because it is difficult to locate those employees. The contacts must be done through the assistance of IT departments. Future research may try to obtain support from a number of large organizations so that they can provide the necessary information to contact the respondents directly.

In addition, respondents of this study are system users who have also involved in the system development. This sample may produce an upward-bias to the evaluation of the user satisfaction towards the information system because higher level of commitment and ownership to a project may cause higher level of user satisfaction.

The current study has adopted the SERVPERF to the study of the system development service quality. We believed that this is a fruitful step into the area that has not been paid enough attention. Further study may improve the current one by developing a service quality measurement that is specific to the context of system development.

Information system departments' role as service providers has become increasingly important and service quality becomes an important issue. This study applies successfully the service quality concept to the study of system development process. This provides a new perspective in studying system development, which has proven useful from the results of the study.

References

[1] H.Almutiri and G.H.Subramanian, An Empirical Application of the Delone and Mclean Model in the Kuwaiti Private Sector, The Journal of Computer Information Systems 45 (3) (2005) 113.

[2] J.C.Anderson and D.W.Gerbing, Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach, Psychological Bulletin 103 (3) (1988) 411-423.

[3] E.Babakus and G.W.Boller, An empirical assessment of the SERVQUAL scale, Journal of Business Research 24 (1992) 253-268.

[4] J.E.Bateson, Managing Services Marketing, (London, Dryden Press, 1989).

[5] P.M.Bentler, On the Fit of Models to Covariance and Methodology to the *Bulletin*, Psychological Bulletin 112 (3) (1992) 400-404.

[6] T.J.Brown, G.A.Churchill and J.P.Peter, Improving the Measurement of Service Quality, Journal of Retailing 69 (1) (1993) 127-139.

[7] J.M.Carman, Consumer Perceptions of Service Quality: an Assessment of the SERVQUAL Dimension, Journal of Retailing 66 (1) (1990) 33-55.

[8] C.L.Carr, Reciprocity: The Golden Rule of IS-User Service Relationship Quality and Cooperation, Communications of the ACM 49 (6) (2006) 77-83.

[9] J.C.-J.Chang, G.Torkzadeh and G.Dhillon, Re-examining the Measurement Models of Success for Internet Commerce, Information & Management 41 (5) (2004) 577-584.

[10] J.J.Cronin and S.A.Taylor, Measuring Service Quality: A Reexamination and Extension, Journal of Marketing 56 (1992) 55-68.

[11] P.A.Dabholkar, D.I.Thorpe and J.O.Rentz, A Measure of Service Quality for Retail Stores: Scale Development and Validation, Journal of the Academy of Marketing Science 24 (1) (1996) 3-16.

[12] W.H.Delone and E.R.McLean, Information Systems Success: The Quest for the Dependent Variable, Information System Research 3 (1) (1992) 60-95.

[13] W.H.DeLone and E.R.McLean, The DeLone and McLean model of information systems success: A ten-year update, Journal of Management Information Systems 19 (4) (2003) 9.

[14] D.Gefen and M.Keil, The Impact of Developer Responsiveness on Perceptions of Usefulness and Ease of Use: An Extension of the Technology Acceptance Model, DATA BASE 29 (2) (1998) 35-49.

[15] D.W.Gerbing and J.C.Anderson, An Updated Paradigm for Scale Development Incorporating Unidimensionality and Its Assessment, Journal of Marketing Research XXV (1988) 186-192.

[16] V.Grover, M.J.Cheon and J.T.C.Teng, The Effect of Service Quality and Partnership on the Outsourcing of Information Systems Functions, Journal of Management Information Systems 12 (4) (1996) 89-116.

[17] J.F.Hair, B.Black, B.Babin, R.E.Anderson and R.L.Tatham, Multivariate Data Analysis, (Upper Saddle River, N.J., Pearson Prentice Hall, 2006).

[18] J.E.Hunton and J.D.Beeler, Effects of user participation in systems development: A longitudinal field experiment, MIS Quarterly 21 (4) (1997) 359.

[19] J.J.Jiang, G.Klein and S.M.Crampton, A note on SERVQUAL reliability and validity in information system service quality measurement, Decision Sciences 31 (3) (2000) 725.

[20] J.J.Jiang, G.Klein, D.Tesch and H.-G.Chen, Closing the user and service provider quality gap, Communications of the ACM 46 (2) (2003) 72.

[21] E.Karahanna and D.W.Straub, The Psychological Origins of Perceived Usefulness and Ease-of-Use, Information & Management 35 (1999) 237-250.

[22] W.J.Kettinger and C.C.Lee, Perceived Service Quality and User Satisfaction with the Information Services Function, Decision Sciences 25 (5/6) (1994) 737-766.

[23] W.J.Kettinger and C.C.Lee, Pragmatic Perspectives on the Measurement of Information Systems Service Quality, MIS Quarterly 1997 (June) (1997) 223-240.

[24] W.J.Kettinger and C.C.Lee, Zones Of Tolerance: Alternative Scales For Measuring Information Systems Service Quality, MIS Quarterly 29 (4) (2005) 607.

[25] W.J.Kettinger, C.C.Lee and S.Lee, Global Measures of Information Service Quality: A Cross-National Study, Decision Sciences 26 (5) (1995) 569-588.

[26] Y.J.Kim, M.T.I.Eom and J.H.Ahn, Measuring Is Service Quality In The Context Of The Service Quality-User Satisfaction Relationship, Journal of Information Technology Theory and Application 7 (2) (2005) 54.

[27] U.R.Kulkarni, S.Ravindran and R.Freeze, A knowledge management success model: Theoretical development and empirical validation, Journal of Management Information Systems 23 (3) (2006) 309-347.

[28] J.Y.Lai, Assessment of employees' perceptions of service quality and satisfaction with e-business, International Journal of Human-Computer Studies 64 (9) (2006) 926-938.

[29] H.Landrum and V.R.Prybutok, A service quality and success model for the information service industry, European Journal of Operational Research 156 (3) (2004) 628.

[30] H.Landrum, V.R.Prybutok and X.Zhang, A comparison of Magal's service quality instrument with SERVPERF, Information & Management 44 (1) (2007) 104-113.

[31] H.-F.Lin and G.-G.Lee, Determinants of success for online communities: an empirical study, Behaviour & Information Technology 25 (6) (2006) 479-488.

[32] C.H.Lovelock, Managing Services: Marketing, Operations, and Human Resources, (New Jersey, Prentice-Hall, 1992).

[33] T.Lynch, Gregor and hirley, User participation in decision support systems development: Influencing system outcomes, European Journal of Information Systems 13 (4) (2004) 286.

[34] Q.Ma, J.M.Pearson and S.Tadisina, An exploratory study into factors of service quality for application service providers, Information & Management 42 (8) (2005) 1067-1080.

[35] J.D.McKeen, T.Guimaraes and J.C.Wetherbe, The Relationship Between User Participation and User Satisfaction: An Investigatiion of Four Contingency Factors, MIS Quarterly 1994 (December) (1994) 427-450.

[36] B.L.Myers, L.A.Kappelman and V.R.Prybutok, A Comprehensive Model for Assessing the Quality and Productivity of the Information Systems Function: Toward a Theory for Information Systems Assessment, Information Resources Management Journal 10 (1) (1997) 6-25.

[37] M.Newman and D.Robey, A Social Process Model of User-Analyst Relationships, MIS Quarterly (June) (1992) 249-266.

[38] A.Parasuraman, L.L.Berry and V.A.Zeithaml, Refinement and Reassessment of the SERVQUAL Scale, Journal of Retailing 67 (4) (1991) 420-450.

[39] A.Parasuraman, V.A.Zeithaml and L.L.Berry, A Conceptual Model of Service Quality and Its Implications for Future Research, Journal of Marketing 49 (Fall) (1985) 41-50.

[40] A.Parasuraman, V.A.Zeithaml and L.L.Berry, SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality, Journal of Retailing 64 (1) (1988) 12-40.

[41] L.F.Pitt, R.T.Watson and C.B.Kawan, Service quality: a measurement of information systems effectiveness, MIS Quarterly 19 (2) (1995) 173-187.

[42] L.F.Pitt, R.T.Watson and C.B.Kavan, Measuring Information Systems Service Quality: Concerns for a Complete Canvas, MIS Quarterly 1997 (June) (1997) 209-221.

[43] A.Rai, S.S.Lang and R.B.Welker, Assessing the validity of IS success models: An empirical test and theoretical analysis, Information Systems Research 13 (1) (2002) 50.

[44] A.Rai and V.Sambamurthy, Editorial Notes - The Growth of Interest in Services Management: Opportunities for Information Systems Scholars, Information System Research 17 (4) (2006) 327-331.

[45] P.J.Rondeau, T.S.Ragu-Nathan and M.A.Vonderembse, How involvement, IS management effectiveness, and end-user computing impact IS performance in manufacturing firms, Information & Management 43 (1) (2006) 93-107.

[46] R.Sabherwal, A.Jeyaraj and C.Chowa, Information System Success: Individual and Organizational Determinants, Management Science 52 (12) (2006) 1849.

[47] P.B.Seddon, A Respecification and Extension of the DeLone and McLean Model of IS Success, Information System Research 8 (3) (1997) 240-253.

[48] A.H.Segars and V.Grover, Strategic Information Systems Planning Success: An Investigation of the Construct and Its Measurement, MIS Quarterly 22 (2) (1998) 139-163.

[49] G.Shostack, Service Positioning Through Structural Change, Journal of Marketing 51 (1987) 34-43.

[50] T.P.Van Dyke, L.A.Kappelman and V.R.Prybutok, Measuring Information Systems Service Quality: Concerns on the Use of the SERVQUAL Questionnaire, MIS Quarterly 1997 (June) (1997) 195-207.

[51] T.P.Van Dyke, V.R.Prybutok and L.A.Kappelman, Cautions on the Use of the SERVQUAL Measure to Access the Quality of Information Systems Services, Decision Sciences 30 (3) (1999) 877-891.

[52] V.Venkatesh and F.D.Davis, A Model of the Antecedents of Perceived Ease of Use: Development and Test, Decision Sciences 27 (3) (1996) 451-481.

[53] R.T.Watson, L.F.Pitt and C.B.Kavan, Measuring information Systems Service quality: Lessons from Two Longitudinal Case Studies, MIS Quarterly 1998 (March) (1998) 61-79.

[54] J.R.Weitzel and G.B.Graen, System Development Project Effectiveness: Problem-Solving Competence as a Moderator Variable, Decision Sciences 20 (1989) 507-531.

[55] J.-H.Wu and Y.-M.Wang, Measuring KMS success: A respecification of the DeLone and McLean's model, Information & Management 43 (6) (2006) 728.

Appendix A Scales and Items

All items were measured on a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (2), except the User Satisfaction items, which were measure on a 7-point scale from very dissatisfied (1) to very satisfied (7).

System Development Service Quality

Assurance

ASSU1: The behavior of IT staff provided confidence to the users in the development process.
ASSU2: IT staff were consistently courteous with users in the development process.
ASSU3: IT staff had the knowledge to do their job well in the development process.

Empathy

EMP1: IT staff gave users personal attention in the development process.
EMP2: IT staff had the users' best interests at heart in the development process.
EMP3: IT staff gave users individual attention in the development process.
EMP4: IT staff understood the specific needs of the users in the development process.

Reliability

REL1: When IT staff promised to do something in the system development process within a certain time, they did so.
REL2: When users had problems relating to the system, IT staff showed sincere interest in resolving them.
REL3: IT staff performed their tasks in the development process reliably.
REL4: IT staff finished their tasks in the development process at the time they had promised.
REL5: IT staff provided accurate modifications during the system development process.

Responsiveness

RES1: IT staff told users exactly when their tasks in the development process would be performed.
RES2: IT staff were always willing to help users during the development process.
RES3: IT staff were never too busy to respond to user requests during the development process.
RES4: IT staff handled user requests promptly during the development process.

Tangible

TAN1: The IT department has up-to-date hardware and software.
TAN2: The IT department office appears organized.
TAN3: The IT staff were well dressed and neat in appearance.

Information Quality

IQ1: The system provides precisely the information that I need.
IQ2: The system provides accurate information.
IQ3: The output information is as relevant as I had expected.
IQ4 The system provides me timely information.

System Quality

SysQ1: Learning to use the new system was easy for me.
SysQ2: I find it easy to use the system to do what I want to do.
SysQ3: It was easy for me to become skilful at using the system.
SysQ4: I find the system easy to use.

Perceived Usefulness

PU1: Using the system improves my work performance.
PU2: Using the system increases my work productivity.
PU3: I find the system useful for my work.
PU4: Using the system enhances my effectiveness in my work.
PU5: Using the system provides me with information that would lead to better decisions.

User Satisfaction

USAT1: How would you rate your overall satisfaction with the system?
USAT2: How satisfied are you with the system?
USAT3: Your evaluation of the system is: