Antecedents of Application Service Continuance: An Empirical Exploration

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Abstract

Although ASP (Application Service Provider) has the potential to fundamentally change the manner in which IT services are provided for user firms, current ASPs often fail to show robust records in accumulating and maintaining customers. In order to fill the gap between the expected benefits of application service and its disappointing results in real world, we propose a conceptual model to explore the effects of ASP performance (System Quality, Information Quality, and Service Quality), Satisfaction, and Trust on Continuous Intention to Use. The model is empirically tested using the data from two hundred and three small and medium enterprises with application service experiences. Data analysis results using LISREL indicate that Satisfaction and Trust have significant effects on the client firm's Continuous Intention to Use. Trust is found to be the most salient determinant while previous studies mainly focused on the role of Satisfaction. Furthermore, the empirical support is found for the direct effect of Service Quality on Continuous Intention to Use as well as its mediating effects.

Keywords: ASP; Application Service; IS Continuance; Small Business; Trust; Agency Theory

1. Introduction

While many companies are aware that taking advantage of information technology (IT) is essential to remain competitive, its development and maintenance have been both costly and time-consuming. Furthermore, their internal departments are finding difficulties in managing the complexity of IT and retaining internal IT expertise. These difficulties make businesses increasingly rely on third-party vendors to capitalize on organizational data-processing resources [McFarlan and Nolan, 1995]. With these corporate needs and the proliferation of the Internet, ASP (Application Service Provider) has become a viable option for businesses. ASP "manages and delivers application capabilities to multiple entities from a data center across a wide area network (WAN)" [Susarla, Barua and Whinston, 2003]. It provides network-based access services for enterprises that do not have in-house IT resources. ASP may have advantages over the in-house solutions in view of the shortage of IT resources, increasing complexity of systems management, and rapid evolution of technologies.

ASP tends to be adapted by small and medium enterprises (SMEs) because it can provide applications that these firms are commonly incapable of developing and maintaining. SMEs are generally slow to employ and utilize IT due to their resource poverty and lack of IT expertise [Thong, 1999]. Typically, SMEs are incapable of implementing and maintaining information systems without the help of external expertise [Soh, Yap and Raman, 1992]; the potential benefits of application service are expected to be substantial. The global application service market is expected to grow from $1.5 billion in 2003 to $3.6 billion in 2008 [Bachelet and Ring, 2004]. However, it shows much slower acceptance rate compared with this optimistic initial forecasts [Fortune, 2000; IDC, 2002]. In spite of the considerable benefits of the ASP model, current ASPs have failed to accumulate and retain customers [Caufield, 2000; Desai and Currie, 2003].

It is well known for service marketers that "having customers, not merely acquiring customers, is crucial for service firms" [Berry, 1980]. As Reichheld and Sasser [1990] stated, customer defections have a strong impact on the bottom line of businesses. Slight increases in customer retention rates can have a critical impact on a firm's vitality because acquiring a new customer costs more than retaining an existing customer.

Although customer retention is crucial for service providers like ASPs, current information system (IS) research has not shown much attention to investigating the antecedents of continuous use of application service, which are keys to retain current user firms. This lack of attention holds particularly true for IS continuance research, which remains considerably understudied in comparison to IS adoption studies. Furthermore, due to the embryonic status of application service, the majority of previous application service studies are conceptual or descriptive. Therefore, the research with empirical validations on the continuous use of application service is of interest. This paper propose a continuous use model for application service with 203 small business samples by focusing on the role of the ASP performance, satisfaction, and trust.

2. Research background

2.1 ASP model

ASP has received much attention from business organizations due to the low cost and the large shortage of up-to-date related IT skills. Consequently, the ASP model may be especially welcomed by SMEs [Kern, Kreijger and Willcocks, 2002], which typically suffer from resource

poverty [Palvia, 1996; Thong, 1999] and the lack of IT capabilities [Riemenschneider, Harrison and Mykytyn, 2003; Soh, Yap and Raman, 1992].

ASP shares many common aspects with traditional IT outsourcing. Therefore, it is frequently viewed as an extreme form of selective outsourcing [e.g. Bennett and Timbrell, 2000; Chen and Soliman, 2002; Currie and Seltsikas, 2001; Kern, Kreijger and Willcocks, 2002; Soliman, Chen and Folick, 2003]. However, although ASP and IT outsourcing are seemingly similar, they differ in application ownership, system location, pricing model, and the relationship type between the provider and client companies. Among them, relationship type between ASPs and their clients and the system ownership particularly need to be noted. Traditional IT outsourcing can be characterized with a one-to-one relationship between the outsourcing firm and the client with fully customized service offerings. By contrast, ASPs often provide standardized IS applications for multiple customer organizations with relatively little customization. Another notable difference is that the application and system ownership belongs to ASPs in the ASP model. Therefore, ASPs may have control over data from each individual organization. Therefore, the most organizations are reluctant to allow ASPs to have control over their data [Kearney, 2000], although they often lack their own IT departments [Yao and Murphy, 2002]. Client organizations find difficulties in monitoring and controlling the ASPs' opportunism.

As a result, the client organizations of application service should have the faith that the ASPs are trustworthy. Widespread concerns about ASP data security [e.g. Bennett and Timbrell, 2000; Dewire, 2000; Ekanayaka, Currie and Seltsikas, 2003; Sharma and Gupta, 2002; Soliman, Chen and Folick, 2003] make it imperative to select reliable ASPs. The study of Kakabadse and Kakabadse [2002] shows that the data security concern is very serious among application service clients.

2.2 Satisfaction

Satisfaction can be defined as a postpurchase evaluation of product quality given prepurchase expectations [Kotler, 1991]. Delivering satisfaction to customers has been a central concept in both marketing and IS disciplines. A number of researchers are dedicated to enhancing our understanding of the antecedents and consequences of satisfaction. Considerable works in modern marketing have been devoted to exploring the determinants of customer satisfaction [e.g. Churchill and Surprenant, 1982; Oliver and DeSarbo, 1988; Tse and Wilton, 1988] and its links to customer behavioral intention [e.g. Cronin and Taylor, 1992; Yi and La, 2004]. Similarly, IS studies on satisfaction have theorized user satisfaction as one of the most important IS success measures [e.g. Bailey and Pearson, 1983; Ives and Olson, 1983; Melone, 1990].

Customer satisfaction is found to be positively associated with customer behavioral intentions such as repurchase intention [Anderson and Sullivan, 1993; Szymanski and Henard, 2001; Yi and La, 2004], future purchase intention [Cronin and Taylor, 1992; Doney and Cannon, 1997] and

more directly, customer behavior itself such as repurchase [Mittal and Kamakura, 2001] and extended relationship with customers [Bolton, 1998; Ganesan, 1994; Rust and Zahorik, 1993].

2.3 Trust

Trust is important for many economic activities that can involve undesirable opportunistic behaviors because avoiding these behaviors is the key to successful economic transactions, although it is not a trivial task to define and measure trust. While there is a widespread lack of common trust concept, most researchers believe that trust is a multidimensional concept [Mayer, Davis and Schoorman, 1995; Rousseau, Sitkin, Burt and Camerer, 1998]. Some researchers define trust as a specific belief about the trustee's integrity, competence, and benevolence [Doney and Cannon, 1997; Ganesan, 1994; Gefen, 2004]. Others define trust as a willingness to be vulnerable to the actions of another party [Mayer, Davis and Schoorman, 1995; McKnight, Cummings and Chervany, 1998] or willingness to rely on another [Doney, Cannon and Mullen, 1998]. McKnight et al. [1998] proposed an integrated model which includes disposition to trust, institution based trust, trusting belief, and trusting intention and empirically investigated their validity [McKnight, Choudhury and Kacmar, 2002a].

Previous trust literature suggests that trust can reduce risk and uncertainty in trust related behaviors [McKnight, Choudhury and Kacmar, 2002a], transaction costs [Mishra, 1996], and disputes involved in many economic transactions [Ring and van de Ven, 1994]. Trust is also helpful for facilitating collaboration among organizations because organizations often rely on their partners' performance and remain vulnerable to the partner's opportunistic behaviors [Kumar, 1996]. The literature on IS outsourcing has particularly emphasized the mutual trust between two parties as one of the most important factors for outsourcing success [Cullen, Johnson and Sakano, 2000; Grover, Cheon and Teng, 1996].

Trust is particularly needed when the truster lacks adequate control over the trustee [Das and Teng, 1998; Dasgupta, 1988]. Winning trust from customers is essential for ASPs because most application service customers face rather high operational and business risks in choosing and maintaining their application service [Bennett and Timbrell, 2000]. The ASP model's inherent security risks and the ASP customers' lack of control measures on the opportunistic behaviors of ASPs lead ASP customers to rely on trust.

3. Research method
3.1 Research model

We propose a research model as shown in Figure 1. In brief, we posit that Intention to Continuous Use is influenced by Satisfaction with the application service and Trust in the ASP. The ASP's perceived performance may be measured by three distinct dimensions – System, Information, and Service Quality [Lee, Kim and Kim, 2006], The model implies that these aspects of ASP performance directly affect both Satisfaction and Trust. The research model also shows that Satisfaction with the application service affects Trust in the

ASP. The direct effect of Service Quality on Intention to Continuous Use is modeled based on the results of previous studies performed in the context of the service industry [Zeithaml, Berry and Parasuraman, 1996], ASP service [Liu and Ma, 2005], and IT outsourcing [Grover, Cheon and Teng, 1996]. We discuss each of the proposed relationships in the proposed model as follows.

<Figure 1. Conceptual Research Model>
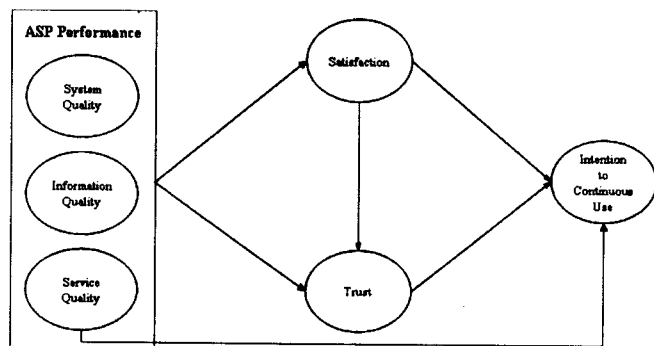
3.2 Hypothesis development
The effects of ASP performance
Early IS studies largely evaluated IS performance from the perspective of (i) the quality of the system itself such as accessibility, response time, integration, efficiency, and system flexibility and (ii) the quality of information such as information accuracy, completeness, relevance, precision, and currency [Bailey and Pearson, 1983; Ives and Olson, 1983]. However, IS organizations are increasingly performing the dual role of both information and service provider because of the growth of end-user computing, decentralization, and the available choices for sources of IS services [Myers, Kappelman and Prybutok, 1997]. Pitt et al. [1995] suggested that the performance of the IS service function should be assessed to measure the effectiveness of IS properly. Many previous studies [e.g. Ballantine, Bonner, Levy, Martin, Munro and Powell, 1996; DeLone and McLean, 2003; Kettinger and Lee, 1994; Kettinger and Lee, 1997; Myers, Kappelman and Prybutok, 1997] have considered the service function as an essential ingredient of IS. Furthermore, one of the key differences between the application service and the traditional information system is the sustained relationship between the ASPs and the end-user organizations. Accordingly, ASP performance can be measured in terms of *System Quality, Information Quality*, and *Service Quality*.

The performance of a product and service has frequently been modeled as a direct antecedent of satisfaction in marketing literature [Oliver and DeSarbo, 1988; Tse and Wilton, 1988]. The direct influence of performance on satisfaction can be reasoned from the notion of a value-percept diversity; In other words, customers tend to be more satisfied with an offering as the ability of the offering to provide consumers what they need, want, or desire increases relative to the costs incurred [Johnson, 1998]. Similarly, the perceived quality of IS are modeled as directly affecting user satisfaction in IS research [DeLone and McLean, 1992; DeLone and McLean, 2003; Myers, Kappelman and

Prybutok, 1997] and empirically confirmed its significance [Pitt, Watson and Kavan, 1995; Rai, Sandra and Welker, 2002]. Susarla et al. [2003] also supported the notion that the perceived quality of an ASP has a positive direct effect on the satisfaction of users.
Hence:

H1a: *System Quality* of ASP systems is positively related with *Satisfaction* with ASP service.
H1b: *Information Quality* of ASP systems is positively related with *Satisfaction* with ASP service.
H1c: *Service Quality* of ASP is positively related with *Satisfaction* with ASP service.

People tend to make trust related assumptions about others on the basis of their knowledge [McKnight, Cummings and Chervany, 1998]. When people feel that the performance of the ASP is of high quality, they are likely to postulate that the ASP has beneficial characteristics. That is, people generally assume that the ASP is competent and beneficial when they feel that the quality of system, information, and service is satisfactory. In turn, it will promote trust in the ASP. McKnight et al. [2002a] note that the perceived quality of web site directly affects trust for web vendors in their web trust model. The relationship between the perceived quality of others and trust has been supported in the web-based information system environment [Belanger, Hiller and Smith, 2002; McKnight, Choudhury and Kacmar, 2002b]. Therefore, it is hypothesized that *System, Information Quality* of ASP system and *Service Quality* of ASP have direct positive effects on Trust.
Hence:

H2a: *System Quality* of ASP systems is positively related with *Trust* in ASP.
H2b: *Information Quality* of ASP systems is positively related with *Trust* in ASP.
H2c: *Service Quality* of ASP is positively related with *Trust* in ASP.

Delivering quality service is a well-known success factor in the service industry. Customers' intentions to stay with a firm can be improved by providing quality service [Bitner, 1990]. The service literature reveals the close relationship between *Service Quality* and behavioral intention variables such as "intention to repurchase" or "intention to switch" [Boulding, Kalra, Staelin and Zeithaml, 1993; Kearney, 2000]. Zeithaml et al. [1996] suggest that *Service Quality* directly affects behavioral intentions in their model for the behavioral consequences of service quality. Although there are some exceptions [e.g. Cronin and Taylor, 1992], the direct influence of *Service Quality* on behavioral intention is supported in the service industry [Kearney, 2000], traditional IS outsourcing [Grover, Cheon and Teng, 1996], and ASP service [Liu and Ma, 2005]. The behavioral intention of the ASP client can be interpreted as *Intention to Continuous Use* in the case of ASP service.
Hence:

H3: *Service Quality* of ASP is positively related with *Intention to Continuous Use*.

The effects of satisfaction

Favorable experiences with the object of trust is one of the most important antecedents for building trust in that object [Blau, 1964; Kramer and Tyler, 1996; Luhmann, 1979]. Zucker [1986] suggested that the satisfactory experience with other's past behaviors is essential in promoting trust. A highly satisfying experience with the ASP service will not only consolidate a user's trust in ASP but also promote trust between a user and ASP. The adaptation level theory may explain the positive association between satisfaction and trust; the relational expectations of trust may adapt to the user's satisfaction level, which is the encounter-specific outcomes of customer evaluation. That is, if users consistently perceive that their service experience is of a high quality, it will convince users of the competence and benevolence of the service provider. With this theoretical background, Singh and Sirdeshmukh [2002] argue that satisfaction directly influences trust in their satisfaction-trust-loyalty framework. The proposed relationship is empirically supported within the ERP (Enterprise Resource Planning) customization context. Gefen [2004] found that a satisfactory past experience performs a crucial role in building trust between an ERP vendor and its clients. Similarly, it would appear that customers who have a satisfactory experience with ASP tend to form high trust in ASP.
Hence:

H4a: *Satisfaction* with the application service is positively related with *Trust* in ASP.

The link between customer satisfaction and behavioral intention has been widely accepted in consumer research [Yi and La, 2004]. The behavioral intention often means repurchase intention or switching behavior in previous studies. The attitude-behavior consistency argument [Oliver, 1997] provides the basis of the strong association between satisfaction and the intention. That is, a satisfactory experience with a product or service is likely to enhance a favorable attitude toward the product or service. It explains the close relationship between satisfaction and behavioral intentions because attitude is a well-known determinant of behavioral intentions.
Szymanski and Henard [2001] found that repeat purchasing is one of the most frequently assumed consequences of customer satisfaction. A number of prior studies empirically support the positive relationships between satisfaction and repurchase intention [Anderson and Sullivan, 1993; Yi and La, 2004]. Rust and Zahorik [1993] show that customer retention rate is driven by customer satisfaction. The relationship duration of cellular customers is positively related with customer satisfaction [Bolton, 1998]. IS literature also reveals the close relationship between satisfaction and continuance intention. Satisfaction is reported as a strong antecedent of IS continuance intention [Bhattacherjee, 2001b] and e-commerce service continuance

intention [Bhattacherjee, 2001a].
Accordingly, we may propose that:

H4b: *Satisfaction* with the application service is positively related with *Intention to Continuous Use*.

The effect of trust

Agency theory assumes that information asymmetry and opportunism are the fundamental parts in the principal-agent relationship [Eisenhardt, 1989]. The intangibility of a service inherently leads information asymmetry to be a common characteristic of service consumption [Singh and Sirdeshmukh, 2002]. Measuring the overall performance of application service is a complex task. Therefore, application service users face the great risk of ASPs' opportunism. Furthermore, small businesses, which have a large part of their current application service customer basis, are generally incompetent in monitoring and controlling the opportunistic behaviors of ASPs because of their resource poverty [Palvia, 1996; Thong, 1999] and lack of IT expertise [Riemenschneider, Harrison and Mykytyn, 2003; Soh, Yap and Raman, 1992]. The prevalence of a standardized contract for a application service [Yao and Murphy, 2002] makes it more difficult for application service clients to control ASPs properly. The role of trust becomes imperative under the condition with these risk and information asymmetry. Trust operates as a governance mechanism to curb the service provider's opportunism. Application service clients can have confidence in an ASP's cooperation by selecting a trustworthy vendor as their partner.
The significant influence of trust on trusting intention is generally accepted [Grabner-Krauter and Kaluscha, 2003; McKnight, Choudhury and Kacmar, 2002a]; trusting intention can be interpreted as making a purchase, and/or giving personal information in e-commerce. It can be considered as *Intention to Continuous Use* in our research model. Trust has been considered as a key variable for maintaining the good relationship with customers by marketing scholars. Morgan and Hunt [1994] found that trust positively affects relationship commitment and decreases the propensity to leave.
Social exchange theory (SET) [Blau, 1964] may help explain the role of trust in behavioral intention formulation. SET views social interaction in a similar manner to economic exchange which is characterized by costs and rewards. Like economic exchanges, people participate in social exchanges when their expected consequences from the exchanges are satisfactory. The main difference between economic and social exchanges is that a social exchange deals with situations where there is no explicit or detailed contract binding the parties or when the contract is insufficient to provide a complete legal protection for all of the parties involved. Therefore, because guaranteed rewards cannot exist in a social exchange, trust is essential and determines people's expectations from the relationships. Trust increases the perceived certainty concerning other people's expected behavior [Luhmann, 1979] and reduces the fear of being exploited [Zand, 1972]. Consequently, trust encourages people to participate in social exchanges with

unguaranteed rewards. The social exchange can be regarded as buying products in commerce, continuing the use of systems in IS domain, or maintaining application service subscriptions.

The relationship between trust and trust related behavioral intention is empirically supported within the context of online legal service [McKnight, Choudhury and Kacmar, 2002b], the online marketplace [Gefen, 2000; Gefen, 2003; Liu, Marchewka, Lu and Yu, 2004; Pavlou and Gefen, 2004], and ERP customization [Gefen, 2002; Gefen, 2004]. This relationship would hold in the case of ASP.

Accordingly, we propose that:

H5: Trust in ASP is positively related with Intention to Continuous Use.

3.3 Pretest and pilot survey

A pretest and a pilot survey were conducted before the main survey to enhance the validity of the proposed model's measurement items [Straub, 1989]. In order to assure the content validity in the ASP context, two faculty members, two MIS doctoral students, and three KNCA (Korea National Computing Agency) researchers reviewed a set of questionnaire items based on relevant previous research. The content validity of the questionnaire items was examined [Boudreau, Gefen and Straub, 2001] through personal interviews with the users of two SMEs currently using ASP applications. After reviewing interview results, slight wording changes were made to reduce confusion among business practitioners about the questions. A pilot survey was conducted using the revised questionnaire items. Two hundred and seventy seven ASP users participated in the pilot survey through mail, web, and onsite visit surveys.

In order to ascertain the reliability and construct validity of the questionnaire items adopted for the pilot survey, the internal consistency method and confirmatory factor analysis (CFA) were performed. Most items were found to have applicable reliability and construct validity.

3.4 Main survey

After the pretest and the pilot test, the final set of the questionnaire items to be used in the main survey was confirmed. A multiple-item method was used to construct the questionnaire. All items except Satisfaction employed the seven-point Likert-type scale from 'strongly disagree' to 'strongly agree'. Satisfaction was measured by the use of the seven-point semantic differential scales. Although original service quality measures include five dimensions – tangibles, reliability, responsiveness, assurance, and empathy, the item of tangible dimension is excluded because the tangible dimension is found to be unstable in several studies of the IS domain [Kettinger and Lee, 1994; Parasuraman, Berry and Zeithaml, 1991; Van Dyke, Kappelman and Prybutok, 1997]. Most of the measures were adopted from the relevant previous studies. The conceptual definitions of instruments and their related research are summarized in Table 1.

A web survey was adopted for the main survey in view of its several benefits such as low costs and rapid survey response [Schaefer and Dillman, 1998; Tan and Teo, 2000].

Respondents to the survey were recruited through bulletin boards and popup window notices on the ASP application web sites of Korea Telecom and Hanaro Telecom. An introductory page, which explained the purpose of the study, the intended use, and the guarantee of the confidentiality, was shown to the respondents before the survey questionnaires were filled in. To minimize possible common method bias, the survey was designed into two separate parts. All respondents can fill in the second part of the survey questionnaire after submitting the first part. This time lag may work as the temporal separation of measurement which is one of the recommended control measures for common method bias [Podsakoff, MacKenzie, Lee and Podsakoff, 2003]. About a $5 valued coupon was provided for all respondents in order to raise the response rate.

We obtained 223 responses from the main survey. Eleven responses were from the firms with more than 100 employees; they were discarded for organizational size control. Nineteen responses were discarded because fourteen of them were only partially completed and five were considered as outliers. Two hundred and three questionnaires were used for the final analysis. For data analysis, SPSS 13 and LISREL 8.54 were employed.

Table 1 Construct Definitions, Items, and related studies

Construct	Conceptual Definition	Measures		Related Research
System Quality	User's perception on performance of information system itself	SQ1	Response Time	DeLone and McLean [1992]
		SQ2	System Reliability	
		SQ3	System Availability	
Information Quality	The quality of the information that the system produces	IQ1	Accuracy	DeLone and McLean [1992]
		IQ2	Format	
		IQ3	Timeliness	
Service Quality	User's perceptions on the service provider's performance	SV1	Responsiveness	Kettinger and Lee [1997]
		SV2	Reliability	
		SV3	Assurance	
		SV4	Empathy	
Trust	Truster's perception that trustee has attributes that are beneficial to the truster	TR1	Benevolence	McKnight et al. [2002b]
		TR2	Integrity	
		TR3	Competence	
Satisfaction	A positive affective state resulting from the appraisal of all aspects of the service	SF1	Dissatisfied/Satisfied	Spreng et al. [1996]
		SF2	Displeased/Pleased	
		SF3	Frustrated/Contented	
		SF4	Terrible/Delighted	
Intention to continuous use	Intention to continue using the service	CU1	Continuation intention	Bhattacherjee [2001b]
		CU2	Alternative means	
		CU3R	Discontinuation intention	

4. Data analysis
4.1 Sample characteristics

Most of the sample companies have less than 50 employees (85.7%) and the average duration for ASP usage is around one year. Finance and accounting modules are the most popular application service. Most respondents are in their twenties and thirties. Male and female are almost fifty-fifty. The details of sample respondents are shown in Table 2.

4.2 Descriptive statistics and construct correlations

Means, standard deviations, ranges, and correlation among latent variables are reported in Table 3. After multiple-item scales were summed and averaged, these descriptive statistics were estimated. The correlations between latent variables are estimated by the use of LISREL. All correlations between latent variables are significant at p < 0.01.

Table 2. Organization Characteristics

Item	Category	Freq.	Percent
Number of Employees	Less than 5	29	14.3
	5 to below 10	51	25.1
	10 to below 30	58	28.6
	30 to below 50	36	17.7
	50 to below 100	29	14.3
Industry	Manufacturing	53	26.1
	Information	47	23.2
	Health care and social assistance	2	1.0
	Real estate, rental and, leasing	3	1.5
	Accommodation and food services	4	2.0
	Arts, entertainment, and recreation	2	1.0
	Wholesale and retail trade	25	12.3
	Transportation	3	1.5
	Professional, scientific, and technical services	18	8.9
	Educational service	3	1.5
	Other services	43	21.2
Duration of Use	Less than 3 months	41	20.2
	3 months to below 6 months	50	24.6
	6 months to below 12 months	43	21.2
	12 months to below 24 months	26	12.8
	More than 24 months	43	21.2
Category of Applications	Finance and accounting	151	74.4
	Groupware	17	8.4
	Office automation	18	8.9
	e-Commerce application	7	3.4
	Others	10	4.9

Table 3. Respondents Characteristics

Item	Category	Freq.	Percent
Gender	Male	98	48.3
	Female	105	51.7
Age	Less than 20	1	0.5
	20 to below 30	108	53.2
	30 to below 40	77	37.9
	40 to below 50	14	6.9
	Equal to or more than 50	3	1.5
Job Experience	Less than 1 year	15	7.4
	1 to below 5 years	82	40.4
	5 to below 10 years	68	33.5
	10 to below 15 years	21	10.3
	Equal to or more than 15 years	17	8.4

4.3 Reliability and validity of the measures

The measurement model fit, reliability, and construct validity was assessed by the use of a confirmatory factor analysis (CFA). Seven common model-fit measures were used to validate the measurement model; chi-square/degree of freedom, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), non-normed fit index (NNFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMSR). All of the model-fit indexes exceed their respective common acceptance levels suggested by the prior literature [Chau, 1997; Hair, Anderson, Tatham and Black, 1998]. Therefore, it may be concluded that the measurement model has good fit with the data gathered ($\chi2/df=208.78/155=1.347$, GFI=0.906, AGFI=0.873, NNFI=0.994, CFI=0.995, RMSEA=0.041, and SRMSR=0.032).
The reliability of measurement items was assessed by the

internal consistency method. Cronbach's alpha is generally considered to provide a reasonable estimate of internal consistency. These values range from 0.912 to 0.964. The Cronbach's alpha value for each construct surpasses the recommended value of 0.60 or 0.70 [Hair, Anderson, Tatham and Black, 1998; Nunnally, 1978].
The convergent validity is evaluated by the use of item reliability, average variance extracted (AVE) [Fornell and Larcker, 1981], and t-values for all factor loadings [Hair, Anderson, Tatham and Black, 1998]. The item reliability of each item is higher than the 0.50 cut off value. All constructs also exceeded the recommended AVE value 0.50 [Chau, 1997; Fornell and Larcker, 1981]. Additionally, all t-values of the constructs exceeded the critical value of 3.29 at p < 0.01 level. Thus, it is noted that the measurement scale support the acceptable convergent validity [Anderson and Gerbing, 1988]. The details of this reliability and convergent validity test are shown in Table 4.

Table 4. Descriptive Statistics and Pairwise Construct Correlations

Variables	SQ	IQ	SV	TR	SF	CU
System Quality (SQ)	1.000					
Information Quality (IQ)	0.632	1.000				
Service Quality (SV)	0.588	0.703	1.000			
Trust (TR)	0.522	0.677	0.692	1.000		
Satisfaction (SF)	0.456	0.563	0.584	0.584	1.000	
Intention to Continuous Use (CU)	0.529	0.641	0.696	0.749	0.582	1.000
Mean	4.39	4.65	4.75	4.90	4.86	5.10
Standard Deviation	1.39	1.31	1.50	1.25	1.74	1.58
Min	1	1	1	1	1	1
Max	6.67	7	7	7	7	7

Table 5. Reliability and Convergent Validity Test

Construct	Item	FL	t-value	IR	Cronbach's α	CR	AVE
SQ	SQ1	0.850	14.677	0.723	0.912	0.914	0.779
	SQ2	0.913	16.456	0.834			
	SQ3	0.884	15.623	0.781			
IQ	IQ1	0.898	16.125	0.806	0.918	0.919	0.790
	IQ2	0.896	16.069	0.803			
	IQ3	0.873	15.402	0.762			
SQ	SV1	0.939	17.726	0.882	0.964	0.964	0.871
	SV2	0.940	17.780	0.884			
	SV3	0.920	17.100	0.846			
	SV4	0.935	17.611	0.874			
TR	TR1	0.945	17.935	0.893	0.965	0.966	0.904
	TR2	0.963	18.596	0.927			
	TR3	0.944	17.922	0.891			
SF	SF1	0.892	16.176	0.796	0.954	0.956	0.844
	SF2	0.933	17.484	0.870			
	SF3	0.943	17.843	0.889			
	SF4	0.905	16.594	0.819			
CU	CU1	0.969	18.645	0.939	0.934	0.938	0.834
	CU2	0.933	17.480	0.870			
	CU3R	0.833	14.476	0.694			

* FL: Factor Loading, IR: Item Reliability, CR: Construct Reliability, AVE: Average Variance Extracted

Discriminant validity can be assessed by performing a pairwise $\chi2$ difference test between the constrained and unconstrained model [Anderson and Gerbing, 1988; Chau, 1997]. The $\chi2$ difference exceeding 30.09 at a degree of

freedom one suggests that the measurement scales have an acceptable level of discriminant validity. The χ2 value differences range from 253.18 (Information Quality and Service Quality) to 932.59 (Service Quality and Satisfaction). The discriminant validity test results suggest that the measurement scales are acceptable. The details are shown in Table 5.

4.4 Additional measurement related issues

Testing for the non-response bias: Non-response is a potential source of bias in survey research. To address this issue properly, a non-response bias test was performed according to Armstrong and Overton [1977]. Responses received after one week were treated as late ones. The test compared six constructs' means in the research model. The t-test on our constructs showed no significant differences between early and late responses (p < 0.05 level). Therefore, we may conclude that no serious non-response bias was noted with the test result.

Testing for the common method bias: As noted by Bagozzi and Yi [Bagozzi and Yi, 1991], common method bias is the one of the main sources of systematic measurement error. The exclusive reliance on self-reported survey data may be indicative of common method bias in the study's measurement. To address this issue properly, Harman's single-factor test was conducted using CFA, which is a procedure to assess the severity of method bias [Podsakoff and Organ, 1986]. The hypothesized model ($\chi2=341.21$, df=247, p<0.001) was found to fit the data significantly better than the single factor model ($\chi2=3163.90$, df=275, p<0.001). This result suggests that the probability of common method variance is not strong [Podsakoff and Organ, 1986].

Assessment of the possible coverage error: Web surveys are increasingly proliferating as a data collection method in academia as well as in business fields. Despite its obvious advantages over traditional data collection methods, web surveys have been frequently discredited in terms of survey quality. One of the most serious threats to the quality of an online survey is its coverage error [Couper, 2000]. Coverage error is a function of both the proportion of the target population that is not covered by the sample frame and the difference in the survey statistics for those covered and those not covered [Groves, 1989]. That is, the coverage problem of the web survey becomes serious when the part of the target population doesn't have internet access because the web survey method can only be accessed by internet users. In terms of the coverage problem, the web survey method is appropriate for this study because all application service users already have established internet access. Therefore, possible coverage error due to our online survey is expected to be negligible.

4.5 Analysis results
The structural model was estimated with MLE (Maximum Likelihood Estimation) and the covariance matrix. As summarized in Table 8, all overall goodness of fit indexes

exceed recommended cut-off values. Therefore, our research model exhibits quite good fit with the data gathered, as suggested by the inspected goodness-of-fit indexes exceeding or corresponding to their recommended values commonly suggested in the prior literature [Chau, 1997]. Explanatory power of the model is also fairly high; R2 values range from 0.392 (*Satisfaction*) to 0.636 (*Intention to Continuous Use*). Most coefficients are significant at p<0.01 as shown in Figure 2. The path coefficient from *Satisfaction* to *Intention to Continuous Use* is significant at p<0.05. But, our study does not find empirical support for the expected effects of *System Quality*. Path coefficients from *System Quality* to Satisfaction and Trust are not significant even at p < 0.10. Therefore, the hypothesis H1a and H2a are rejected. The details of the data analysis results are summarized in Figure 2 and Table 6.
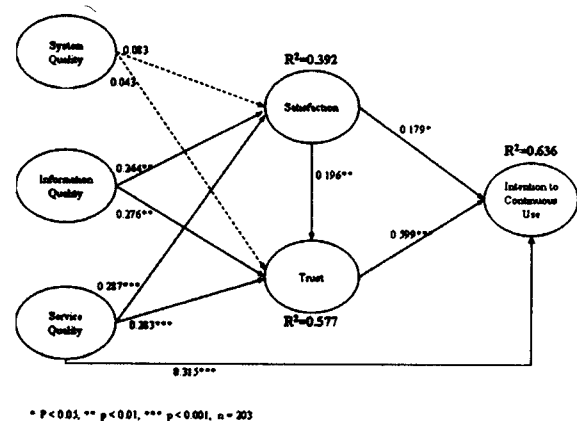

* P<0.05 ** p<0.01, *** p<0.001, n=203

Figure 2. Data Analysis Results

Table 6. Overall Goodness of Fits for the Structural Model

Goodness-of-fit Measure	Recommended Value	Observed Value
Chi-square/degree of freedom	≤ 3.0	1.352 (212.24/157)
Goodness-of-fit Index (GFI)	≥ 0.90	0.905
Adjusted Goodness-of-fit Index (AGFI)	≥ 0.80	0.873
Non-Normed Fit Index (NNFI)	≥ 0.90	0.994
Comparative Fit Index (CFI)	≥ 0.90	0.995
Root Mean Square Error of Approximation (RMSEA)	≤ 0.08	0.042
Standardized Root Mean Square Residual (SRMSR)	≤ 0.10	0.034

Service Quality exhibits the strongest direct effects on *Satisfaction*. What's more, *Service Quality* exhibits both the strongest direct and indirect effect for building the client firm's *Trust* in ASP. Contrary to our expectation, it is found that the effects of *System Quality* on both *Satisfaction* and *Trust* are not statistically significant. It is a rather intriguing result considering that the previous studies [Rai, Sandra and Welker, 2002; Seddon and Kiew, 1994] empirically support the positive effect of *System Quality* on *Satisfaction*. The detailed coefficients of direct, indirect, and total effect and their t-values for each path are summarized in Table 7.

Table 7. Explanatory Power of the Model and Strength of Individual Paths

	R²	Direct effect	Indirect effect	Total effect
Effect on User Satisfaction	0.392			
System Quality		0.083 (0.997)	-	0.083 (0.997)
Information Quality		0.244 (2.716)	-	0.244 (2.716)
Service Quality		0.287 (3.834)	-	0.287 (3.834)
Effect on Trust	0.630			
System Quality		0.043 (0.619)	0.016 (0.942)	0.059 (0.828)
Information Quality		0.276 (3.534)	0.048 (2.060)	0.324 (4.125)
Service Quality		0.283 (4.291)	0.056 (2.368)	0.339 (5.194)
Satisfaction		0.196 (2.995)	-	0.196 (2.995)
Effect on Intention to Continuous Use	0.636	-	0.050 (1.025)	0.050 (1.025)
System Quality		-	0.238 (3.910)	0.238 (3.910)
Information Quality		0.315 (4.211)	0.254 (4.713)	0.569 (7.984)
Service Quality		0.179 (2.260)	0.117 (2.739)	0.297 (3.496)
Satisfaction		0.599 (6.612)	-	0.599 (6.612)
Trust				

*t-values are specified in parenthesis.
*Indirect effects, total effects and their t-values are calculated by LISREL EF procedure.

5. Discussions of results

5.1 Explaining the continuance intention of application service

The study results show that *Trust, Satisfaction,* and *Service Quality* are strong predictors of the continuance intention to use the application service. More than sixty three percent of the variance of *Intention to Continuous Use* are explained with those three constructs ($R^2=0.636$). The service and information dimension of ASP performance was found to have both significant direct effects on *Trust* and *Satisfaction* and a indirect effect on *Intention to Continuous Use*. However, the system dimension of ASP performance doesn't posit significant direct and indirect effects on *Trust, Satisfaction,* and *Intention to Continuous Use*. *Service Quality* also exerts a significant direct effect on the continuance intention.

Furthermore, *Trust* and *Service Quality* were found to be crucial in explaining the application service continuance. *Trust* was the strongest predictor of the continuance intention ($\beta=0.599$). In terms of total effect on the continuance intention, the magnitude of *Service Quality* was found to be nearly equivalent with the one of *Trust*. On the other hand, *Satisfaction* posits significant, but rather limited explaining power in forging the continuance intention compared to the effects of *Trust* and *Service Quality*.

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5.2 The role of *Trust*

Satisfaction has been widely accepted as one of the most critical factors affecting customer behavioral intention and behavior in marketing [Szymanski and Henard, 2001]. On the background of the consumer satisfaction literature, a number of IS studies have mainly focused on examining the role of satisfaction to understand a user's IS continuance behavior [e.g. Bhattacherjee, 2001a; Bhattacherjee, 2001b; Hsu, M.Chiu and Ju, 2004]. For example, Bhattacherjee [2001b] found that satisfaction is the strongest predictor of IS continuance intention in his model. The effect of satisfaction is almost twice as high as the perceived usefulness, which is the most important predictor of technology acceptance intention. By contrast, the role of trust has received only minimal attention from IS researchers. Results of our study support the significant effect of satisfaction. But, its effect was found rather limited. Instead, trust is found to be a major determinant of the continuance intention to use the application service. To understand this result fully, it is worth noting that some studies report the different role of satisfaction and trust under the different customer relationship orientation. Gabarino and Johnson [1999] showed that while satisfaction had a significant effect on future intentions of transactional customers, this effect was not significant for relational customers. In contrast, trust was the strongest determinant of the future intention of the relationship oriented customers. The causal relationship between trust and long-term commitment is empirically supported by a considerable number of studies in the case of buyer-seller relationships [Doney and Cannon, 1997; Morgan and Hunt, 1994] and IS [Gefen, 2004]. Application service can be characterized by its relationship orientation as well as information asymmetry between ASPs (agents) and their clients (principals). Therefore, a trustworthy ASP is essential for application service success. In the light of these considerations, it is not surprising that the effect of trust is relatively strong in forging a user's continuance intention to use the application service compared with the effect of satisfaction.

The above finding has important implications for IS research and practice. The relationship orientation of users may moderate the relationships of IS continuance intention with satisfaction and trust. IS continuance determinants and their effects should be understood with the unique characteristics of user groups and technologies. For instance, ASPs' sole reliance on user satisfaction improvement and ignorance of mutual trust building can lead to disastrous consequences in terms of customer retention.

5.3 The effect of *System Quality*

System Quality has been considered as a typical IS success measure [e.g. DeLone and McLean, 1992; DeLone and McLean, 2003; Myers, Kappelman and Prybutok, 1997; Seddon, 1997]. Although its positive relationship with user satisfaction is also empirically supported in the prior IS studies [Rai, Sandra and Welker, 2002; Seddon and Kiew, 1994], the effect of *System Quality* is found to be very limited in our analysis. The corresponding hypotheses H1a and H2a are not statistically significant even at $p < 0.10$.

Herzberg's two factor theory [Herzberg, 2003; Herzberg, Mausner and Snyderman, 1959] may help explain this discrepancy in *System Quality* effects. Herzberg found that some factors are consistently related to job satisfaction – the motivation factor, and the others to job dissatisfaction – the hygiene factor. He argued that the presence of hygiene

factors is necessary, but not sufficient enough to lead to satisfaction.

Based on Herzberg's two factor theory, Zhang and Dran [2000] classified website design factors into two distinct categories: motivation and hygiene. The technical aspects of a website such as system loading time and availability are the most salient hygiene factors among the twelve website design factors [Zhang and Dran, 2000; Zhang, Dran, Small and Barcellos, 2000]. Their research results suggest that the technical aspects of a website such as *System Quality* could not lead to a positive evaluation by users, but only prevent a negative evaluation. Similar results could be found in Yang and Fang [2004]'s study on online service quality dimensions that contribute to customer satisfaction. Consistent with Zhang and Dran [2000]'s results, *System Quality* is identified as a hygiene factor and the positive contribution to customer satisfaction is not found [Yang and Fang, 2004]. In the light of these study results, *System Quality* may operate as a hygiene factor for application service.

5.4 Implications for IS practitioners

Our study provides IS practitioners several implications. First, to retain the current customer base, ASPs need to focus on building mutual trust with existing customers. Trust is found to be a central element to predicting the application service continuance in terms of the direct effect as well as the total effect. Second, ASPs should not overlook the human factors in the relation with their client firms. It is found that the quality of service dimension positively affects not only trust and satisfaction but also the continuance intention itself. Service quality can be improved mainly through adequate service encounters between the employees of an ASP and its customers. Furthermore, service quality is the most crucial factor in establishing trust which has a great impact on the continuance intention. In contrast, allocating corporate resources to improve system quality needs to be controlled carefully so that it is not excessive. Our study indicates that the system quality is not an effective measure to enhance the user's trust and satisfaction, at least in the context of the application service.

5.5 Limitations of the study

Our study has several limitations. First, most of our sample businesses are SMEs with less than 50 employees. Therefore, our research findings may not be generalized across all businesses in terms of organization size. Our research results should be cautiously interpreted within the context of small businesses. However, the majority of the prior research [Bennett and Timbrell, 2000; Chen and Soliman, 2002; Currie and Seltsikas, 2001; Kern, Kreijger and Willcocks, 2002] have suggested that the current application service provides SMEs with significant benefits. Furthermore, a large percentage of the existing ASPs are targeting SME sectors. Consequently, our study results may represent the current state of the application service industry.

The second limitation is the possibility of non-response bias. All respondents were recruited using bulletin board notifications and the popup windows via the main web pages of the ASP service websites. Therefore, the response rate for our study could not be calculated. Although the non-response bias test showed no significant difference between early and late respondents, this may not completely rule out the possibility of bias. Therefore, the data analysis results should be interpreted with caution.

Third, our research is solely based on the self-reported cross sectional survey data. As a result, the study findings may be vulnerable to common method bias. In order to avoid the possible common method bias, recommended procedural remedies [Podsakoff, MacKenzie, Lee and Podsakoff, 2003] were taken; (i) assuring respondent anonymity, (ii) counterbalancing question order, and (iii) inserting a temporal separation between the online survey response forms. Harman's single factor test also suggests that the common method variance is not severe. Nonetheless, it may not be fully assured that the study findings are free from common method bias. We may just partially allay the concerns about common method bias. Future research can avoid this problem by taking separate measurements for predictors and criterion variables from different sources.

6. Conclusion

To identify and understand the critical antecedents of the application service continuance, we proposed and empirically validated a model in terms of trust, satisfaction, and ASP performance. The data collected from 203 SMEs empirically support the proposed model. Our data analysis using LISREL shows that these three variables explain about sixty four percent of the variance for the application service continuance intention. It also indicated that trust and service quality are essential elements in retaining the current application service clients. Consistent with previous studies, satisfaction is found to have a significant effect on the continuance intention, but the magnitude of the effect is rather limited compared with trust and service quality in terms of the effect size. Our study findings suggest that each dimension of ASP performance may have different role in building mutual trust, improving satisfaction level, and formulating the continuance intention to use the application service.

* All appendixes and reference are excluded due to the page limit. If you want the appendixes and the reference list, please contact the authors by email.