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## **An integrative model of clients' decision to adopt an Application Service Provider**

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# **AN INTEGRATIVE MODEL OF CLIENTS' DECISION TO ADOPT AN APPLICATION SERVICE PROVIDER**

A Dissertation

Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

in

The Interdepartmental Program in Business Administration  
(Information Systems and Decision Sciences)

by

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May 2004

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# DEDICATION

To the memory of my father, Sanyuan Yao, a wonderful man of faith, patience, and wisdom. He is my strength and purpose in life. He gave me the model of life that I have lived to this day. I am the extension of his life. Dad, all my accomplishment is for you.

To my husband, Xiaoxiao Tang, who is the true love of my life and my best friend. His extraordinary faith in my ability, ceaseless encouragement, and emotional support inspired me in this long journey.

To my mother, Zhuli Li, and brother, Yugang Yao, who always believed in me and supported me in everything. They were always there for me, offering love and care, and cheering me on.

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# ABSTRACT

Application Services Providers (ASPs) exploit the economics of delivering commercial off-the-shelf software over the Internet to many dispersed users, but the decision-making process to adopt the ASP business model can be complex requiring a comprehensive consideration of various factors. As a new form of outsourcing, the ASP business model differs from traditional outsourcing models with respect to the attributes associated with vendors, clients, and applications. These differences are expected to demand decision models that are distinct from those in the traditional IS outsourcing.

In this study, an integrative model for ASP adoption that incorporates economic determinants, strategic determinants, and social determinants is developed. This integrative model includes the individual effects of these determinants, as well as the moderating effects of the social determinants upon the economic and strategic determinants.

To test this research model and its associated hypotheses, two self-administered surveys, one among clients of a leading ASP and the other among nationally selected top computer executives, are conducted. The findings from the two surveys show that economic, strategic and social factors impact a client's decision on ASP adoption. Moreover, among prospective ASP adopters, trust had a strong tendency to influence the effect of cost benefits and IT deficiency removal on ASP adoptions.

This study empirically examines the determinants of ASP adoption from an integrative perspective. This model contributes to the academic literature by presenting a broad view for understanding ASP adoption decision. The findings from the survey elucidate the independent impact of the economic, social and strategic perspectives as well as interactions among the three perspectives for ASP adoption. For practitioners, this study can shed insight on special determinants in ASP adoption. It can help ASPs gain a better understanding of clients' concerns for ASP adoption and make corresponding adjustments in the services in order to attract clients and increase application usage.

# CHAPTER 1 INTRODUCTION

This study investigates the factors that influence clients when they consider whether or not to adopt Application Service Providers (ASP). In this chapter, a general introduction of IS outsourcing is provided, and the ASP business model is presented. Then the background of this research, with particular attention to the factors that motivated this particular study is provided. Next, an important research void regarding ASP adoption decision-making is addressed. Following is a discussion of the specific research questions. Finally, the outline of the dissertation chapters is provided.

## 1.1 IS Outsourcing and the ASP Business Model

Originating with the financial and operational services sectors in the 1960s and 1970s, IS outsourcing has existed for about four decades. Since its inception, IS outsourcing has experienced tremendous changes, in the scope of what is outsourced from initial software development to server hosting and application maintenance; in the degree of application customization from case by case customization to commercialization and standardization; and in infrastructure ownership from clients to vendors (Lacity, et al., 1995). For example, in 1989, Kodak totally outsourced its IS department to IBM and its partners. It was a flagship event that publicized outsourcing as an alternative IS management approach (Applegate and Montealegre, 1991). Moreover, the explosion in Internet IT outsourcing connectivity and increased bandwidth, coupled with the ubiquitous nature of computing, has made delivery of software applications from remote data centers technologically feasible and economically attractive. Thus, the ASP business model, a new form of outsourcing, has emerged.

The ASP business model assumes that an ASP remotely provides enterprise applications via a wide area network, e.g. the Internet, to one or more clients (Susarla, et al., 2003). This one-to-many ASP hosting model will lend itself to certain ASP economies-of-scale by providing standard applications to multiple clients (Gillan, et al., 2000). This model dramatically changed the software delivery mechanism from purchased licensing to leased web services (Greene, 2001). In the ASP business model, an ASP will generally take the full responsibility for software

purchase, application maintenance and ongoing updates, while clients may require only a Web browser to access its applications online. To acquire these services, an ASP's clients are commonly charged a fixed minimum cost plus a variable fee based on usage time or user sign-on activities (Koch, 2000). One practitioner characterized acquiring ASP services as similar to buying voice mail services from a telephone company (Kearney, 2000).

ASPs became popular in the early 1990s and since then have grown. Currently, ASPs play an increasingly important role in influencing IT resources decision making (Lacity and Willcocks, 2001).

## **1.2 Research Background**

In the IS discipline, ASP research falls under the general area of IS outsourcing. Swanson (1994) argued that IS outsourcing is assumed to be one of the critical IS product and business administrative process innovations. It significantly changes the pattern of product/service delivery in an organization and thus is deemed to exert a profound impact on business operations (Loh and Venkatraman, 1992). As a new type of IS outsourcing, the ASP business model also potentially plays a critical role in the operations of companies (Walsh, 2003).

A tremendous amount of research has been conducted in the area of IS outsourcing, from the early works of Buchowicz (1991) on make-or-buy decision, the groundbreaking work of Lacity and Hirschheim (1993) on IS outsourcing, to the more recent works of Kern, et al. (2002a), and Ye and Agarwal (2003) on strategic partnership, and the study of Benamati and Rajkumar (2003) on adoption decision. Nevertheless, the ASP business model differs from the traditional IS outsourcing model in significant ways, including software ownership, target clients, customization, production functions, and contract length (Yao and Murphy, 2002). So, close scrutiny of this ASP business model is essential.

The ASP business model has already been studied by some academics (e.g., Susarla, et al., 2003; Jayatilaka, et al., 2003; Kern, et al., 2002). However, as a very complex decision process, the adoption decision on ASP still calls for more extensive and empirical investigation. Susarla, et al., (2003) recently emphasized that using ASP is a critical option for a company to

operate and maintain information technology and it is very valuable to thoroughly understand a client's decision to adopt an ASP. Lee, et al., (2002) provided a historical view of IS outsourcing and proposed the ASP model as an important area to research. They summarized that three categories of well-developed theories – economic, social and strategic – have been used to better understand the IS outsourcing decision (e.g., Grover, et al., 1998; Lee and Kim, 1999; Willcocks and Lacity, 1998; Smith and Rupp, 2003). However, very few empirical study have used these all these three perspectives to investigate the ASP adoption decision. Hence, from an academic perspective, it is reasonable to employ all these theories and apply them to the domain of ASP. Devaraj, et al., (2002) demonstrated that it is an effective approach to employ multiple perspectives in order to study a research question thoroughly

Moreover, among these three perspectives, some factors may exert different impacts on the ASP adoption decision than the other factors. The moderating effects will change the influences of some factors on the ASP adoption decision. Thus, it is interesting to examine the individual and interactive effects of economic, strategic and social factors on the ASP adoption decision.

From a practitioner's perspective, it is also clear that the ASP business model is gaining increasing attentions from both clients and vendors even though it seems to still have a number of hurdles -- improving capabilities, seeking the match between standard application and client's requirements and educating clients about ASP business model -- to cross over in order to gain critical mass.

On the client side, small or medium enterprises discover that the ASP business model is a possible way for them to cut costs while maintaining the same level of IT services. The ASP business model is regaining some ground it lost during the market's decline. On the vendor side, besides a number of newly established ASPs offering services, the big players in the industry, such as IBM, SAP and Siebel, have become more and more active in delivering online applications to clients.

The Gartner Group even predicts that in 2004, the ASP market will surpass \$25 billion (Smith and Rupp, 2003). The most recent report released by the well-known research company, International Digital Company (IDC), also projects a 26 percent annual growth rate for the



software-as-a-service market, from \$1.8 billion in 2002 to \$5.7 billion by 2007 (Musich, 2003). With such quick growth, IDC (2002) called for special attention to the changes in the decision-making and business operation processes brought about by the ASP business model. Some researchers have been directed to examine these issues, e.g. Susarla, et al., (2003) and Smith and Rupp (2003).

Moreover, personal interviews conducted by the researcher with CEOs of several ASPs, including NTG, ApproSystems, Statability, and directors of hosting centers in large companies, including PeopleSoft, IBM and SAP, showed that all these vendors had concerns and anxieties about how to attract clients. These executives were extremely interested in a full understanding of a client's considerations on the ASP adoption and the development of a comprehensive model to guide their business operations. Thus, extensively studying the determinants impacting the ASP adoption decision could be very valuable for an ASP.

Besides, the researcher attended a large ASP's annual user conference. Interviews with some clients showed that they need to have a comprehensive consideration about adoption decision of the ASP business model. Facing such a complex and critical decision, clients also need a well-developed model to take various factors into account.

This study is intended to dig deeper into certain aspects of this important and interesting area. This empirical study, leveraged by the previous works, attempts to employ an integrative approach to investigate the impacts of important determinants from the three perspectives (economic, strategic and social) on ASP adoption decisions. Hence, this study will benefit both academic researchers and practitioners.

For researchers, as the ASP business model is significantly different from the traditional outsourcing, this empirical study contributes to the understanding of the ASP business model, particularly in adoption decision perspective. This study also contributes to the literature by explaining client attitudes towards this online software delivery mechanism from a more holistic view. It proposes a unique view to comprehensively examine the individual and interactive impact of determinants on complex decision process from economic, strategic and social perspectives.

For practitioners, it will help ASPs to understand the complex process of a client's ASP adoption decision and adjust their business strategies to satisfy clients' requirements. In addition, it will benefit clients by providing a comprehensive framework to assess ASPs in order to make a rational decision.

### **1.3 Research Questions**

The purpose of this study is to achieve a better understanding of the determinants impacting ASP adoption decisions. This study will explore both individual impacts of these determinants as well as the interactions among these determinants.

To be more specific, the research questions are:

- 1) What economic, strategic, and social determinants impact clients' ASP adoption?

The first question is to address the economic, strategic and social determinants of clients' ASP adoption from an integrative view. Based on the comprehensive evaluation of these determinants, the ASP adoption decision can be better understood.

- 2) What are the interactions among the economic, strategic and social determinants that impact clients' ASP adoption?

The second question investigates interactions among the economic, strategic, and social determinants. It is argued that in the initial stage of ASP adoption, some determinants will impact the effect of other determinants. For example, the social relationship between clients and an ASP might alleviate the effect of economic and strategic considerations on ASP adoption. Thus, it is interesting to examine the interrelationships of these determinants.

This study mainly adopts quantitative methodology. Self-administered surveys among two different populations were employed to investigate determinants impacting clients' decisions for ASP adoption and interactions among these determinants. In addition, case interviews as a qualitative method were utilized to study determinants affecting an online course management systems outsourcing decision. The qualitative data are used to help understand the decision process and explain the findings from the surveys.

## **1.4 Organization of the Document**

The remaining chapters of the dissertation are organized as follows:

Chapter Two – Literature Review: In the second chapter, the definition of ASP is provided. By comparing with the traditional outsourcing model, the features of the ASP business model are presented followed by a practical review of the current ASP market. Then, an extensive literature review on traditional IS outsourcing theories is presented and applied to the ASP context. This review serves as a theoretical foundation upon which to establish a conceptual ASP adoption model.

Chapter Three – Research Model and Hypotheses: In the third chapter, the conceptual model guiding the investigation of economic, strategic and social determinants impacting clients' decisions for ASP adoption is presented. A set of hypotheses regarding the specific relationships introduced in the model is developed.

Chapter Four – Research Design and Data Collection: In the fourth chapter, the research design, including methodology, subjects, and data collection is elaborated. For the quantitative study, the sample, unit of analysis and participants are introduced. Afterwards, the questionnaire development process is described. Finally, the data collection process and data analysis techniques are discussed. For the qualitative study, the unit of analysis, and case selection process are described. Then, specific steps used in data collection and characteristics of the participants are discussed.

Chapter Five – Research Analysis and Results: In the fifth chapter, the results of the survey data are reported. Then, a comprehensive discussion of the data analysis technique utilized to develop valid and reliable instruments, as well as the approach utilized to formally test the hypotheses, is provided. Finally, the results obtained from the statistical analysis are reported.

Chapter Six – Discussion and Conclusion: in the sixth chapter, the in-depth discussion of the findings from two survey studies is provided. Then, the contributions of the study and study limitations are addressed. Finally, the suggestions for future research are discussed.

In the next chapter, the definition of the ASP business model is presented. After the examination on the features of the ASP business model and current ASP market, a review of relevant theories regarding the IS outsourcing decision, particularly related to the economic, strategic and social determinants for IS outsourcing is thoroughly discussed. These theories are further applied to the context of the ASP business model, thus forming the theoretical foundation of the ASP adoption decision model.

## **CHAPTER 2 LITERATURE REVIEW**

This chapter provides a review of the current ASP market and the literature necessary to build the theoretical foundation for this research. In this chapter, the definitions of the traditional IS outsourcing and of the ASP business model are discussed. These two business models are compared according to the characteristics of vendors, clients, and applications. From the practical perspective, the current ASP market is reviewed by discussing the different categories of ASP players. Then from the academic perspective, the existing literature and theories of outsourcing decision making are thoroughly reviewed and applied within the context of ASPs.

### **2.1 ASP and Traditional IS Outsourcing**

General outsourcing activity, “the transfer of operational responsibility of either business processes or infrastructure management to an external service provider” (TripleTree, 2000), can be traced back to the 1950s. The initial motivation of outsourcing was to produce products or finish certain activities with lower costs (Lacity and Willcocks, 1998). Traditional outsourcing focused more on business applications (e.g., payroll processing) and product manufacturing than on technology.

In traditional outsourcing, contract subscription is the principal way to acquire applications externally in order to achieve an optimal resource arrangement (Lee, et al., 2002). For example, Boeing outsources its airplane parts to other manufacturers with comparative advantages (e.g., cheap labor or a special design process) for better cost control (Brown, Hagal III and Durchslag, 2002). Outsourcing as a resource alternative provides companies additional options other than total in-house development. It further causes a change in internal operations and organization management because the companies using outsourcing begin to rely on external vendors. Generally, clients will establish close relationships, such as strategic partnerships, with outsourcing vendors. These close relationships reduce risk and maximize stability for the clients.

As technology develops quickly, information systems become increasingly important in the management and operation of an organization. In order to maintain complex information

systems internally, a high level of expertise is required. In the 1980s, outsourcing of applications associated with information systems or IT infrastructure became increasingly attractive (Lacity and Hirschheim, 1993, Willcocks and Lacity, 1998). IS outsourcing became an important option for IS management. At that time, the major functions outsourced were software development and IT operational activities (McFarlan and Nolan, 1995). Also, internal network infrastructure setup, application design and development, and business process management fell within the scope of functions outsourced (Weston, 2002). Furthermore, IT outsourcing took on a new face in 1989, when Kodak signed a contract that effectively transferred all internal IS functions, personnel, and IT assets to IBM (Willcocks and Lacity, 1998). This total contracting out of IS functions and assets encompassed more than subcontracting. As such, it is not surprising that definitions of outsourcing have ranged from subcontracting selected IS functions to wholesale takeovers of IS business units.

In 1993, Gilbert first used this concept of subcontracting to describe traditional IS outsourcing. He proposed that traditional IS outsourcing occurs when “a third party—the outsourcer”—takes responsibility for the performance of certain services or the operation of certain equipment required for its internal operations” (p. S7). This definition is too narrow in describing outsourced services and applications. In the past few years, IS outsourcing has experienced dramatic changes in service scope and methods. In this study, the outsourcing definition of Grover, et al., (1998, p.80) is adopted because it accommodates the range of outsourcing options while preserving the inside-to-outside transfer of IS functionality:

[IS Outsourcing is an] organizational decision to turn over part or all of an organization’s IS functions to external service providers in order for an organization to be able to achieve its goals.

As one type of outsourcing, ASPs appeared as the result of well-developed network technology (e.g., the Internet). As the ASP business model is a new and evolving element in IT practice, no single definition of ASP dominates research or practice so far. CIO Magazine defines ASPs as “companies that rent software functionality over the Internet or a private network” (Rutherford, 2000). This definition would satisfy observers who have noted the correlation of an ASP to the service bureau model that was more common before the rise of in-house IT departments in the 1960s (Kearney, 2000). The Information Technology Association

of America provides a broader definition of ASP going beyond application service, “[An ASP is] a ‘for profit’ company that provides aggregated information technology resources to clients remotely via the Internet or other networked arrangement” (Paul, 2001). TripleTree (2003), which is a well-known investment bank with a research center focusing on ASP and outsourcing, portrays a more comprehensive picture, “ASP provides management, maintenance, and support services for software applications, [it] delivers application functionality via a remote hosted service and is responsible for maintaining a certain level of availability and functionality.”

In this study, a definition from the ASP Industry Consortium (2001) that is used frequently by other IS researchers (Hearts and Pliskin, 2001; Currie and Seltsikas, 2002; Lee, et al., 2002) is adopted, as it outlines the key characteristics of ASPs:

[An ASP] manages and delivers application capabilities to multiple entities from a data center across a wide area network. (p.8)

Here, the scope of applications has been narrowed in this study. Companies only delivering network infrastructure are not considered to be ASPs.

Currently, ASPs can offer a wide range of applications to their clients (ASPstreet, 2002; ASPisland, 2002), including enterprise systems, collaboration services, E-business, education, and vertical markets specifics (see Table 2-1).

Enterprise management refers to the management of enterprise systems. Enterprise systems are Enterprise Resource Planning (ERP) systems, which cover all the functions associated with enterprise operations, including finance, sales and distribution, human resources, inventory management, and production planning. In this category, some ASPs can offer the full package of enterprise services, while others only concentrate on one function; for example, Employease offers only human resource management, and Salesforce is the biggest market player in providing Sales and Distribution services.

Collaboration services include all the applications for communications and data sharing, e.g., email systems, messaging, online conferencing, data storage and analysis, publishing, and office automation. For example, WebEx, ranked as a top-20 ASP in the whole market, is specializing in providing online conferences.

**Table 2-1 Categories of ASP services (ASPIsland, ASPdictory, ASPnews, 2003)**

Application Service Type	Application Subcategories and Service Examples	ASP Example
Enterprise Management	the whole ERP systems	Agilera, Appshop, Netledger, Oracle, Peoplesoft, SAP, Usinternetworking
	Logistics and Manufacturing	Aspeon technology
	Finance and Accounting, e.g. payroll processing, credit checking	Ultimate Software, Intacct, MetraTech, Miva, EDS, Oracle, Peoplesoft, SAP
	Sales Automation	Aspeon, Salesforce, Salesnet, Upshot
	Human Resources	ADP, Ceridian, PeopleSoft, SAP
Collaborative Services	Email systems, Groupware, Online Meetings and Conferencing, Wireless Messaging, Central Phone Systems	Lotus Notes, Apptix, Placeware, WebEx, Microsoft
	Document management (multi-language/images/audio), Data warehouse, Business Intelligence	Oracle, MS SQL, Enhanced Technologies, Bxmail AG, Integris,
	Publishing management, Company Directory Management	Directory Engine, Active Data Exchange
	Microsoft Office, WordPerfect Office, StarOffice systems	Microsoft, Corel, Sun Microsystems
E-business Service	Wireless business services	Aspective, Sprint, Microsoft
	Online transaction process, e.g. billing	you-invoice.com
	Web-site design and development	Atomz, Aspect development, Parameteric Technologies
	Website analysis	Websidestory
	Supply Chain Management	LivePerson, Milde willes, Aptech
	Customer Relationship Management, e.g. Call Center	Aspective, AMS, Agillion, Siebel
Education and Training	Online learning and teaching, Online book and training	Blackboard, WebCT, Learning Station, Learning Network, MicroTeams, SnowdropSystems, Netexam
Vertical Market Specifics	Healthcare: doctor tracking system, medical records system, insurance billing systems...	HealthIS, eClickMD, HealthTec Soft, MediSolution, Mddatacenter, eHealthEngine
	Hospitality: reporting systems, travel planning, restaurant sales management, property management end-to-end sales	Central Point Technology, Statability, AsiaPacXplorer, SilverByte Management, ADP
	Finance: credit checking	ApproSystems
	Law firms: Intellectual Property Protection	Halo Solution, Network Technology Group, Trion Technologies
	Public Relationship (agency, government, association): Public relationship automation	Vocus
	Real estate: Property Management	Enhanced Technology, App Rent



E-business services include all the applications associated with online transaction processing, for both customers and suppliers. Website development is also covered as one part of the e-business solutions, including website analysis and content development. Although these services are not the mainstream functions in outsourcing, these ASPs, such as Websidestory and Atomz can still create profits on these services.

Education applications include online user-training programs and distance-learning systems. These applications can be used for K-12 education, higher education, and training activities in corporations and governments. For example, Blackboard Company offers online course management services to many universities nationally and internationally.

Vertical market specific refers to value-added products particularly suitable for a specific industry. Currently, the ASPs that provide vertical market specifics are active in many industries, such as healthcare, finance, hospitality, legal services, real estate, retail, and public relationship. Among these industries, finance and healthcare are identified as the two most promising industries for the ASP business model (TripleTree, 2001), because institutions in these two industries generally have a large number of data and seek efficient technology support for data processing.

### **2.1.1 Comparison Between ASP and Traditional IS Outsourcing**

The ASP business model has been developed based on traditional IS outsourcing, but they are different. Yao and Murphy (2002) have identified six attributes that distinguish the traditional IS outsourcing and general ASP business model. Here, these attributes can be further classified into three categories: characteristics of vendors, characteristics of customers, and characteristics of applications. As customers, vendors, and products are the principal components in the market (Porter, 2001), these three major dimensions are widely adopted to compare different business models (Grow and Jay, 1985; Moore, 1998; Currie and Seltsikas, 2002). The comparisons between these two models are summarized in Table 2-2.

In traditional IS outsourcing, agreements are negotiated on a case-by-case basis between a large outsourcing vendor and a large client company. Lacity and Hirschheim (1993) found that large companies perceived outsourcing as a feasible way to reduce IS costs and risks,

**Table 2-2 Characteristics of traditional IS outsourcing vs. the ASP business model**

	Attribute	Traditional IS Outsourcing	Application Service Provision
Customer Characteristics	Target Clients	<ul style="list-style-type: none"> <li>large organizations, e.g., Fortune 500</li> <li>with own IT departments</li> </ul>	<ul style="list-style-type: none"> <li>initially, small or medium-sized organizations with low IT expertise</li> <li>currently, large organizations are involved</li> </ul>
Vendor Characteristics	Vendor Characteristics	<ul style="list-style-type: none"> <li>large corporations</li> <li>with potential global span</li> <li>outsourcing is a small part of business</li> </ul>	<ul style="list-style-type: none"> <li>most ASPs are smaller entrepreneurial firms, lack name recognition, and outsourcing is core revenue stream</li> <li>some new ASPs are large companies with hosting as a small part of business</li> </ul>
Product Characteristics	Functions Provided	<ul style="list-style-type: none"> <li>application development</li> <li>information utilities and business processes</li> <li>operation of internal IT infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>web-enabled application delivery</li> <li>productivity applications, data management, internet access</li> </ul>
	Extent of Customization	<ul style="list-style-type: none"> <li>high customization available</li> </ul>	<ul style="list-style-type: none"> <li>standard software packages</li> <li>clients pay for a customization separately</li> </ul>
	Resource Ownership	<ul style="list-style-type: none"> <li>clients retain ownership of all or some hardware and software</li> <li>clients retain control over custom-developed software</li> </ul>	<ul style="list-style-type: none"> <li>vendors responsible for server hardware, and owning application licenses</li> <li>clients only need web browsers.</li> </ul>
	Contract Types	<ul style="list-style-type: none"> <li>case-by-case detail contract</li> <li>long terms (often ten plus years)</li> <li>strategic partnering “alliance”</li> </ul>	<ul style="list-style-type: none"> <li>standard contracts</li> <li>initial payment and monthly usage fee</li> <li>short terms (one to three years)</li> </ul>

even among clients with well-established IS departments, significant customization of applications, and large IT investments (Grover, et al., 2000; Jurison, 1998). Recent examples of large firms that outsource significant internal IS functions include Boeing (hired EDS to build a private nationwide optical network) (CIO Magazine, 2002a) and Air Canada (hired Unisys to provide cargo application and service development) (CIO Magazine, 2002b). In contrast, typically, ASPs target smaller firms than traditional outsourcing vendors do (M2 Communications, 2000; Rutherford, 2000), because smaller firms may be adequately supported

by shrink–wrapped applications from third-party software companies (Cleaver, 2000). Even mid–sized firms find ASPs attractive as they struggle to keep pace with technology change and increasing workloads with few staffs and minimal budgets (ASP Industry Consortium, 2001; Heart and Pliskin, 2001).

Most traditional vendors are long-established companies with strong IT expertise, such as EDS, IBM, and AT&T, and hosting is only one part of their business (Lacity and Hirschheim, 1993). Usually, they have strong financial foundations and possess good reputations in the industry. In contrast, as the ASP business model emerged, ASP companies were most likely to be newly established small or medium-sized companies, in which online application delivery was the principal part of their business (TripleTree, 2003). However, as the ASP market is growing, it is apparent that more and more large IT companies are joining and subsequently introducing changes into this market (Kavan, et al., 2002).

Traditional outsourcing has covered a very broad scope of functions. TripleTree (2000) classifies traditional outsourcing functions into three types:

- Application outsourcing, including application development and maintenance; (Accenture is an example vendor)
- Information utilities and business process outsourcing, including complex or repetitive business activities such as payroll processing; (DES is an example vendor)
- IT infrastructure operations, including network, hardware, and data center functions (Hewlett–Packard is an example vendor).

Major outsourcing vendors usually can be classified into these categories, such as the example vendors given above, while a few like IBM perform in all categories (TripleTree, 2000). In contrast, ASPs are characterized by their focus on web-enabled application software delivery, whether through the Internet or a dedicated connection. The “universal interface” of a web browser avoids the need to install and control the client side of the application interface. This independence of client from server could significantly alter the possible forms and time scale of interactions compared to traditional outsourcing settings.

Furthermore, traditional outsourcing vendors are more likely to tailor their IS functions to suit clients' specific needs in case-by-case projects (Willcocks and Lacity, 1998), whereas ASPs will tend towards standardization, as ASPs are more likely to gain economic scale by delivering standard applications to multiple clients.

Moreover, in traditional IS outsourcing arrangements, clients need to purchase hardware and software, while vendors further develop and test the systems. The ownership of the final products, such as developed software and implemented systems, belongs to the clients (Willcocks and Lacity, 1998). In contrast, in the ASP business model, ASPs usually own and host all the systems and applications (Gillan, et al., 2001). Clients do not need to purchase software or invest significantly in hardware. They will only own the data that is used to process information. In this way, ASPs are responsible for application establishment, 7/24 maintenance, and timely updates, whereas clients need to have access to Web browsers to utilize leased applications (Gillan, et al., 2001). Without significant investment and maintenance, a "thin" client can be perfectly achieved in the ASP business model.

In addition, as traditional IS outsourcing is a long-term strategic arrangement and covers a broad scope of functions, a detailed outsourcing contract between two large parties will last 7 to 10 years with huge investment (Willcocks and Lacity, 1998) (e.g., Avista's 10-year desktop outsourcing project with EDS, and West Virginia signed a \$61 million eight-year contract with Unisys for outsourcing its healthcare process solution) (*CIO magazine*, 2003). However, ASP contracts have a much narrower scope and shorter term, typically one to three years (Gillan, 2000). This option provides more flexibility to clients. A common pricing approach for clients is a minimum initial setup charge, plus service fees based on time or user sign-ons (Koch, 2000). Thus, clients can easily estimate and control application costs.

Based on the above comparison, it is clear that the ASP business model differs from the traditional outsourcing model significantly.

### **2.1.2 Types of ASP**

Recently, with the inclusion of independent software vendors, this ASP market has become more complicated. Currently, according to the ownership of hosted applications,

TripleTree (2003) groups ASPs into two groups: third-party ASPs, which rent applications or software from a third party and sublease them to clients, and proprietary ASPs, in which ASPs own all the applications and software. This classification clearly distinguishes all ASPs, but it does not catch all characteristics of ASPs' segments. Currie and Seltsikas (2002) catalog ASPs as Enterprise ASPs, Vertical ASPs, Business Service Providers, and Pure-play Providers by assessing their market focus, applications characteristics, risks, and potential development opportunities. These classifications shed a certain insight on the examination of ASPs. However, they focus more on applications distinction and do not exactly reflect the ASP market. In this study, by refereeing some categories used by Currie and Seltsikas (2002), application, client and vendor characteristics are adopted to classify current ASPs. According to these three types of characteristics, ASPs are further grouped into three major categories: Horizontal ASPs, Vertical ASPs, and Independent Software Vendors. In this section, the features of each type of ASP are examined in detail with examples of companies.

#### **2.1.2.1 Horizontal ASPs**

In general, horizontal ASPs refer to small or medium companies providing standard applications online to clients across industries with little or no customization (Currie and Seltsikas, 2002). Horizontal ASPs profit from economies of scale through one-to-many service (Gillan, et al., 2000). They partner with software vendors and lease access rights of software to clients (TripleTree, 2000). Thus, the application software is hosted by ASPs, but owned either by the ASPs themselves or by some third party (e.g., some other software vendors). Usually, horizontal ASPs are small, newly established companies running online applications as their principal business. The clients of horizontal ASPs usually lack IT knowledge, and often have neither a specific IT department nor IT professionals (Gillan, et al., 2000).

There are two subsets of horizontal ASPs: pure-play ASPs that provide all kinds of applications for all industries, and specialists who only offer a single application for clients across many industries. Most pure-play ASPs focus on business solution services or enterprise systems. Usinternetworking (Usi) is the most widely recognized pure-play ASP in the U.S. (TripleTree, 2000). It provides Internet-based end-to-end solutions to middle-sized enterprises. Partnering with Microsoft, PeopleSoft, and Cisco—all well-known, large companies—Usi

delivers 24/7/365 online application packages through its global network infrastructure. By delivering a broad scope of applications, Usi continued to perform well even when the other pure-play ASPs were out of the market (Usi, 2001).

WebEx Communications, Inc. (WebEx), is an example of a specialist. Founded in 1996, WebEx is the leader in real-time communications infrastructure for business meetings on the Web. It provides web-based communication services that integrate voice, video, and data to enable true interaction and collaboration across geographies and platforms. Now, it has over 5,000 corporate clients and thousands of individual users.

#### **2.1.2.2 Vertical ASPs**

Vertical ASPs offer special applications designed for a specific industry, such as software applications for legal firms, healthcare, and hospitality (TripleTree, 2000). Whereas market competition for a horizontal ASP, especially a pure-play ASP, is keen with low-entry barriers (Han, et al., 2001), things are different for a vertical ASP. Familiar with operations and processes in a specific industry, a vertical ASP can design online application packages according to the special demands of those companies in the industries they serve (Heart and Pliskin, 2001). Online application delivery is the principal business for vertical ASPs. By utilizing their deep knowledge of an industry, each vertical ASP has its featured products to market themselves. Most vertical ASP clients may have their own IT professionals, but by outsourcing non-strategic applications, clients can focus on the businesses which can create strategic competitive advantages (Currie and Seltsikas, 2002).

Heart and Pliskin (2001) argued that vertical service providers have a high potential of success. Now, their predictions seem to be true. Currently, vertical ASPs are active in various industries, for instance, Statability offers functional reports for hospitality and retailing industries; HealthIS presents medical recording systems for hospitals, and ApproSystems offers credit checking and loan processing for financial institutions (ASPnews, 2003; ASPstreets, 2003).

### **2.1.2.3 Independent Software Vendors**

Independent software vendors, software companies with application hosting services, are new entrants into the ASP market. Developing and owning software, these ASP players take a special position in the market (TripleTree, 2000). They are top-tier famous vendors, who are strong in software development and maintenance, and have solid financial foundations. High familiarity with software products enables them to provide backend solutions to clients (Columbus, 2000). The driving force for ISVs to enter the battlefield of the ASP market is seeking tighter association with small or medium clients and maximizing their base of application users (Cameron 2001). Usually, application hosting is an extension business to these ISVs, so the ASP center is only a department or a division. These ISVs' ASP centers target small or medium-sized companies who lack financial and technological capabilities for buying and running large software systems in-house. Due to the complexity of application services, the implementation cycle for independent software vendors is the longest among these three ASP market segments (Columbus 2000).

Complex, high-end enterprise software, such as the enterprise planning resource (ERP), customer relationship management (CRM), or supply chain management (SCM), is the major service offered by ISVs. SAP, PeopleSoft, IBM, EDS, Siebel, and Oracle have all begun to provide enterprise applications online (SAP, 2001); especially, IBM runs the biggest hosting service center, with comprehensive online software service solutions for all kinds of clients (IBM, 2003). Microsoft also started its online hosting in 2002.

The features of the three categories - horizontal ASP, vertical ASP, and independent software vendor - are summarized below (See Table 2-3).

Through the above discussion, it is clear that ASP business model present significant differences from the traditional IS outsourcing. Even in the ASP market, the three categories of ASPs vary, while sharing most fundamental features (e.g. online application hosting, short-term contract). Hence, with the above differences in mind, we suggest that the ASP model requires a new understanding of its decision process. The researcher believes that ASPs' clients will focus on different determinants from those considered critical for traditional outsourcing. In the next section, after a review of IS outsourcing decision literatures, multiple theories used for IS

outsourcing decision-making are discussed extensively and applied to the ASP adoption decision. These theories form the foundation of the ASP adoption decision model.

**Table 2-3 Categories of ASP**

	<b>Horizontal ASP ( Cross Industries)</b>		<b>Vertical ASP (Specific Industry)</b>	<b>Independent Software Vendor</b>
	<b>Pure-play ASP</b>	<b>Specialist</b>		
<b>Application Service</b>	General applications to all the clients	Only one application to all the clients	Domain-focused applications	Large enterprise systems or complex suite of software
	Little or no customization	Little or no customization	Little customization; Customized according to the special requirements of the company	Combination of standard applications, industry solution and customized applications
<b>Vendor</b>	ASP service is principal business	ASP service is principal business	ASP service is principal business	ASP service is one part of the business
	Small or newly set up	Small or newly set up	Small or newly set up Industry reputation	Large companies National Reputation
	Purchase or rent software from partners	Purchase or rent software from partners, Offer unique application	Own or rent software from partners, Offer unique solutions	Develop and own the software
<b>Customers</b>	Small or medium companies	All types of companies	All types of companies in specific industry	All types of companies, including large companies
<b>Examples</b>	Usinternetworkin, Processing	WebSideStory, WebEx, Intacct	Vocus, HealthIS, Aspeon	SAP, Oracle, Microsoft

## 2.2 Decision-making Theories

### 2.2.1 Literature Review on IS Outsourcing

As the ASP business model is a new phenomenon under the discipline of outsourcing, ASP research should draw from previous outsourcing research, examine differences between the ASP business model and the traditional IS outsourcing, and further apply the relevant outsourcing theories to the ASP context.

IS outsourcing research has addressed extremely broad issues, including make-or-buy decisions (e.g., Buchowicz, 1991), outsourcing motivations (e.g., Grover, Cheon and Tang, 1996; Willcocks and Lacity, 1998; Yang and Huang 2000), scope and characteristics of outsourcing contracts (e.g., Lacity and Hirschheim, 1993; Lacity and Willcocks, 1998),



performance evaluations criteria (e.g., Benko, 1993; Gupta and Gupta, 1992; Arnett and Jones, 1994; Loh and Venkatraman, 1995) and partnership management (e.g., Klepper, 1995, ; Kern, 1997; McFarlan and Nolan, 1995;, Lee and Kim, 1999). In particular, decision factors for an initial IS outsourcing decision have been closely examined by researchers from different perspectives, such as various costs, characteristics of applications, competence of vendors, client-vendor relationships, institution influences and peer influences, and contract negotiation (e.g., Lacity and Hirschheim, 1993; Loh and Venkatraman, 1992; Ang and Cummings, 1997; Hu, Saunders and Gebelt, 1997, Benamati and Rajkumar, 2003).

At the end of the 1980s, when IS outsourcing was a fashion idea among large companies, Lacity and Hirschheim (1993) conducted a series of interviews with participants in thirteen companies who had evaluated outsourcing decisions and investigated the intentions, motivations and consequences of information systems outsourcing. They found that outsourcing is not necessary for many companies and their internal IS department can sufficiently achieve their goals. Also, many companies seek outsourcing for reasons other than cost efficiency, such as, reacting to the efficiency imperative, acquiring or justifying additional resources, reacting to the positive outsourcing media reports, reducing uncertainty, eliminating a burdensome function and enhancing personal credibility. This is the first work to in-depth study the traditional outsourcing motivations.

Loh and Venkatraman (1992) argued that outsourcing is a significant IT innovation. By using innovation diffusion theory, they investigated the impact of internal influences (e.g., inter-personnel communications with peer companies and imitative behaviors) and external influences (e.g., mass, trade show, and conference) on outsourcing decisions. They empirically studied the outsourcing contracts in the U.S. and found internal influences are more important than the external influences in outsourcing decisions. This work was further enhanced and corrected by Hu, et al. (1997). They fixed the parameters of internal influence coefficient and incorporated mixed influences which include both internal and external influences. Their empirical studies showed that mixed influences impact outsourcing decisions more significantly than do other influences.

In addition to using innovation diffusion theory, Elitzer and Wensley (1997) employed game theory to interpret key aspects of information systems outsourcing arrangements, such as asset transferring, risk sharing, technology upgrading, short contract duration, relationship management and fees structure. Most recently, Benamati and Rajkumar (2003) even used technology acceptance model to study IS outsourcing decision and added environmental uncertainty and previous outsourcing relationship as factors which impact the easy of use and usefulness of outsourcing.

Besides these approaches, there are still many other studies on outsourcing decision making. Particularly, Lee et al., (2002) summarized the history of IS outsourcing and research on this area. They proposed that three important categories of theories - economic, strategic, and social - can help to understand the IS outsourcing decision. Many conceptual studies have been conducted to examine the IS outsourcing decisions from these three perspectives (e.g., Grover, et al., 1998; Ang and Straub, 1998; Ang and Cummings, 1997; Lee and Kim, 1999; Willcocks and Lacity, 1998; Kern, et al., 2002; Smith and Rupp, 2003, Yang and Huang, 2000).

Grover, et al., (1998) presented a conceptual decision model by examining economic factors, such as transaction cost and agency cost, and strategic factors, such as lack of internal resources. Kern, et al., (2002b) further empirically tested this models developed by Grover et al. (1998), by conducting four case studies among companies in the United Kingdom. They found that cost and internal IT deficiency compensation play an important role in the decisions of these companies. Ang and Straub (1998) empirically investigated outsourcing in the banking industry. They found that high transaction cost deters the bankers' intent to outsource, and small and medium-sized companies are more likely to use outsourcing. Also, Ang and Cummings (1997) focused on the moderating effects of internal production costs, transaction costs, and company size on the relationship between institutional influences (peer influence and federal regulation) and outsourcing decisions in the banking industry. They found that production costs and transaction costs impact the relationship between peer influences and IS outsourcing among large banks. Lee and Kim (1999) adopted a social perspective to examine this issue. They argued that the relationship between clients and vendors, represented by trust, communication, business understanding and so on, can affect IS outsourcing decisions and subsequent outsourcing success. Their results showed that high trust can lead to a successful outsourcing relationship.

Most recently, Gorla, Chan, and Oswald (2002) investigated outsourcing determinants from the economic and strategic perspectives. Other researchers have continued making efforts to develop a comprehensive model for IS outsourcing by examining more relevant factors in the IS outsourcing decision (e.g., Goo, et al, 2002; Yang and Huang, 2000).

However, so far, most of these studies have examined only the determinants from one or two perspectives, and no studies have provided a very comprehensive decision model testable in a practical environment with three perspectives together. As each perspective has its weakness and only partially explains the impact of certain determinants on such a complicated decision, previous research lacks a more comprehensive view of traditional IS outsourcing decisions. Moreover, the interactions among the determinants from the three perspectives will change the individual impact of the determinants on traditional IS outsourcing decisions. Thus, it is important to study traditional IS outsourcing decisions from all three perspectives as well as to investigate the interactions among these perspectives. As the ASP business model is one special type of IS outsourcing, this approach should also be applied to the study of ASP adoption decision. Devaraj, Fan and Kohli's work (2002) demonstrated the power of the integrative approach. They adopted the three established frameworks – technology acceptance model, transaction cost analysis and service quality – to examine antecedents of B2C channel satisfaction and preference. They found the integrative model which employs the three frameworks has the significantly higher power of variance explanation, compared with the three individual models. Therefore, it is valuable to investigate the ASP adoption decision process by applying these various perspectives in the ASP context.

Although the approach for studying ASP adoption decisions and traditional IS outsourcing decisions should be the same, the determinants for studying these two kinds of decisions may vary. The ASP business model differs from the traditional IS outsourcing model in significant ways, including software ownership, target clients, customization, production functions, and contract length (Please refer to the previous section for a discussion of these differences). Also, with these distinctions in the characteristics of the two models, the ASP business model and the traditional IS outsourcing have different influences on the companies' internal operations and business reengineering (Chen and Soliman, 2002). Taking these differences into account, the ASP adoption decision demands a unique examination.

Until now, many researchers have started to take a close look at the ASP phenomenon. Kern, et al., (2002b) examined the economic and strategic factors on ASP adoption decisions in the United Kingdom. Based on forty case studies, Lacity and Willcocks (2001) provided operational recommendations on the ASP adoption process, such as, evaluating internal IT resources, getting an external consulting company involved, inviting two ASPs for bids, and closely monitoring service performance. Most recently, Jayatilaka, et al., (2003) investigated about two hundred IT managers and listed the factors impacting their decision to adopt the ASP model. A four-stage model incorporating transaction cost, resource dependence, and knowledge management was developed. Susaria, et al., (2003) investigated ASP after-adoption success by comparing clients' expectations and ASPs' performance, but did not scrutinize ASP adoption decisions.

However, no study has an integrated approach to empirically investigate economic, strategic, and social factors on ASP adoption. It is worth the effort to dig into these factors and examine their individual impact as well as the interaction effect on ASP adoption decision.

In the following sections, based on previous IS outsourcing literature, the theories from the three perspectives are discussed and applied to the ASP context.

## **2.2.2 Economic Perspective**

The economic perspective, consisting of transaction-cost and agency-cost theories, is concerned with the coordination and regulation of economic media in an organization's transactions with one another (Lacity and Hirschheim, 1993, McFarlan and Nolan, 1995, Ang and Straub, 1998).

### **2.2.2.1 Transaction Cost Theory**

Transaction cost theory (TCT), developed originally by Williamson (1979, 1985), has been widely used in management, economics and marketing areas to investigate inter-organizational relationships and a company's competitive advantages (e.g. Walker and Poppo, 1991; Zaheer and Venkatraman, 1995, Rokkan, et al., 2003, Insinga and Werle, 2000). According to this theory, the term "transaction" implies the exchange of materials, information and services between separate units inside or outside the organization. Transaction cost theory

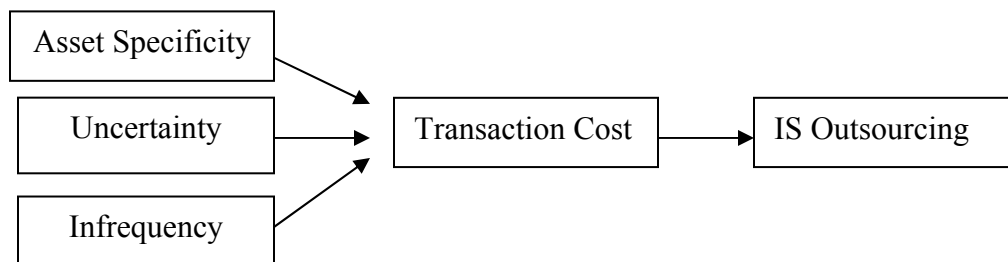
argues that an organization should balance production costs against transaction costs to achieve efficiency (Williamson, 1985).

Two types of costs are identified in transaction cost theory: production cost and transaction cost. Production costs, such as labor expense, raw material purchasing expenses, and machine abrasion, occur when an organization makes products in-house. Transaction costs, such as vendor searches, negotiations, assessment, and monitoring, refer to all the costs associated with material exchange. Transaction cost theory assumes that products are produced more efficiently in a specialized organization. Williamson (1973, 1985) identified three factors in transaction cost theory: asset specificity, uncertainty, and infrequency of contracting. Asset specificity refers to the occurrence of durable investments in specific transactions and the uniqueness of the asset for specific transactions; that is, to what extent there are alternatives. Uncertainty means an unpredictable market, technological change, economic trends, contract complexity, and outcome quality. Infrequency of contracting is the lack of times the two parties negotiate transaction executions. These three factors will influence the transaction cost and efficiency of companies.

TCT provides a framework to evaluate internal production versus external outsourcing alternative (Cheon, et al., 1995, 1998; Lee, et al., 2002) and has been used to study IS outsourcing (McClellan, et al., 1995; Ang and Straub, 1998; Insinga and Werle, 2000, Kern, et al., 2002b). According to TCT, if products can be produced more efficiently in other companies, then application outsourcing will reduce production costs. However, transaction costs may increase with the degree of contract negotiation and regulation. Thus, whether a company chooses outsourcing will depend on the analysis of transaction costs.

Moreover, the three factors of TCT (asset specificity, uncertainty, and infrequency of contracting) exert their influence on IS outsourcing (Cheon, et al., 1995; Grover, et al., 1998). In IS outsourcing, asset specificity refers to the degree of uniqueness of such assets as the hardware, software, or human skills required by clients' outsourced information systems (Ang and Straub, 1998). Outsourced assets could be standard products, products highly specific to a certain organization, or products of mixed specificity. Highly specialized applications will increase transaction costs with vendors, which in turn may impede the decision to outsource. Regarding

uncertainty, when high uncertainty exists due to changes in environmental conditions, a company needs to adapt quickly to these changes. However, a company that outsources will need more negotiations and coordination with its vendor. This need may in turn hinder the company's decision to outsource. Similarly, infrequency of contracting will also increase initial negotiation time and efforts in establishing a relationship and may result in the company's deciding not to outsource. Generally, high asset specificity, high uncertainty, and low frequency of contracting will deter the IS outsourcing decision. Figure 2-1 displays transaction cost theory.



**Figure 2-1 Transaction Cost Theory (adopted from Crover, et al., 1998)**

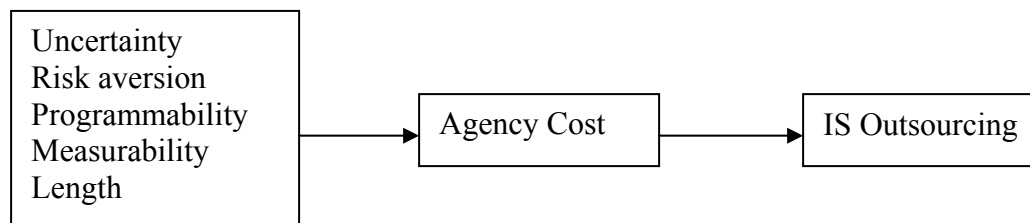
#### **2.2.2.2 Agency Cost Theory**

Agency cost theory (ACT), developed by Jensen and Meckling (1976), Mitnick (1975, 1986), and Ross (1973), investigates the effective contract regulation on the relationship between principals (the parties who receive applications or services) and agents (the parties who provide applications or services). Eisenhardt (1988) summarized this theory and discussed its applications. Jensen and Meckling (1976) defined an agent relationship as a contract relationship which is associated with an agent's commitment to service delivery to a principal.

Agency cost theory argues that the key objective of management is to choose the most efficient contract: a behavior-based contract versus an outcome-based contract, to govern the relationship between agents and principals (Eisenhardt, 1988). Agency costs, caused by discrepancies between benefits of agents and those of principals, consist of three parts: the principal's monitoring cost, the principal's residual cost, and the agent's bonding cost. The principal's monitoring costs occur when a principal examines an agent's performance. The principal's residual cost is incurred when a principal leases or buys functions from an agent with a limited ability. The agent's bonding cost comes out when an agent commits to service delivery

for a principal but fails in executing the contract. Overall, five factors impact agency cost, including uncertainty, risk aversion, programmability, measurability, and length (Eisenhardt, 1988). Uncertainty is influenced by economic, technological and political environments. Risk aversion is the agent and principal's risk-taking perception. Programmability is the extent to which a service provider's behavior can be predicted. Measurability refers to the extent to which outcomes can be evaluated. Length refers to the duration of a contract.

Agency cost theory brings a framework for the outsourcing decision. It can be used to compare the efficiency of different management to handle the contract between a client (a principal) and an ASP (an agent) (Cheon, et al., 1994; Grover, et al., 1998; Kern, et al., 2002b). Good contract management can reduce agency costs for both parties and increase the chances for outsourcing. Generally speaking, when uncertainty is high, risk aversion is high, outcome measurability is low, programmability is low, and length of relationship is long; then IS outsourcing activity is not recommended (Lee, et al., 2002). Agency cost theory is illustrated in Figure 2-2.



**Figure 2-2 Agency Cost Theory (adopted from Crover, et al., 1998)**

However, in the ASP setting, not all of the factors in TCT and ACT are very important or suitable. Infrequency of contract negotiation is not as much of an issue in this context because ASP contracts in practice are generally reevaluated every two years or less (Koch, 2000). This is reflective of the increased demands and uncertainty of the current economy. Short-term contracts tend to reduce contract initiation efforts, and provide flexibility to ASP clients (TripleTree, 2003). It is also not important to evaluate the client's aversion to risk because the short length of ASPs' contract as well as the ASPs' predictable monthly fees significantly reduces the risks associated with an external application lease. Besides, risks involved in the ASP business model refer more to the application service itself, such as response time and data transfer security (Kern, et al., 2002b). In this research, these concerns regarding hosting services are addressed

from the social perspective, particularly by the factor of ASP's capability, so risk aversion is not included as a factor. Programmability is also not a critical factor partly because clients can try an ASP's standard products in advance to make sure that the functions of the products would satisfy their needs. In addition, programmability is more closely associated with ASPs' capability, which has been captured from the social perspective, so programmability is not taken as a factor. Measurability is also not included in this study because compared with ASPs, clients lack expertise with online service delivery and they will tend to use the measurement criteria provided by the ASP to assess their performance (Hearts and Pliskin, 2001). Length of contract is also not very important, as compared with traditional outsourcing arrangements, contract length associated with the ASP business model is relatively short, generally only two or three years. So length is not included as a factor in this study.

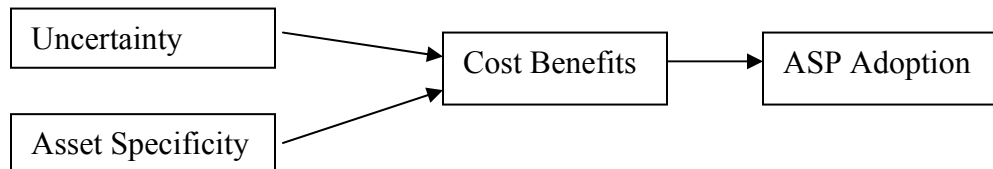
However, uncertainty is still a critical factor for clients to evaluate when they make an ASP adoption decision (Jayatilaka, et al., 2003; TripleTree, 2003). Uncertainty associated with the change of market competition, techniques, economy and industry, impacts organizational management. External uncertainty will cause internal financial stress, such as a tight IT budget with ongoing pressure to cut cost. Also, the quick adaptation to external change in technology and operations will increase internal production and coordination costs (TripleTree, 2003). The clients may therefore gain the advantage of economy-of-scale from external ASPs.

Moreover, the asset specificity of the application also plays an important role, as high asset specificity results in a high dependence of clients on vendors and a high switching cost. Also, highly specific applications demand intensive user training, require more effort in negotiation, and increase subsequent coordination costs. In this case, internal production is more efficient in producing unique systems and gaining competitive advantages than is outsourcing.

Hence, uncertainty and asset specificity will influence ASP adoption through clients' evaluation of their internal production costs compared with the external costs associated with an ASP. Based on TCT and ACT, these external costs include the initial set-up fee, subscription cost, and efforts spent on negotiation and monitoring (Ang and Straub, 1998; Jayatilaka, et al., 2003). With a tight budget in IT investment, reducing internal IT cost is often cited as an important factor that influences the ASP adoption decision (Kern, et al., 2002). Thus, from the



economic perspective, uncertainty and asset specificity are presented here as the two most critical factors influencing ASP adoption through cost benefits. Figure 2-3 illustrates this relationship. Due to possibility of model testing, this sub model cannot include all the factors which may impact the adoption decision from the economic perspective, but can include only the most important factors in this initial stage of model development.



**Figure 2-3 Economic determinants for ASP adoption**

### **2.2.3 Social Perspective**

Besides economic considerations based on transaction cost theory and agency cost theory, Lee and Kim (1999) have introduced a social perspective to examine outsourcing decisions. This approach is based on the social exchange theory and concentrates on the dynamic relationship between clients and service providers.

Social exchange theory was first developed by Thibaut and Kelley (1959) and formalized by Homans (1961), Blau (1964), and Emerson (1972) in the economics research area. This theory emphasizes the exchange relationship developed over time as well as the behaviors of the two specific actors within this relationship (Blau, 1964). Exchange relationship is defined as voluntary transactions involving transfer of resources between two or more parties for mutual benefit (Cook, 1987). It has been used by researchers to address the inter-organizational relationship through non-economic factors, such as trust, interdependency, power, distance... (Dyer and Singh, 1998; Prekumar and Ramamurthy, 1995).

This theory provides a useful framework to investigate the evolving relationship between clients and a software vendor over a long period of time (Lee, et al., 2002). In traditional outsourcing, an established strategic relationship among clients and vendors is considered as a competitive advantage (McLellan, et al., 1995). Similarly, outsourcing application to an ASP is also not a simple one-time transaction, but a relationship that undergoes

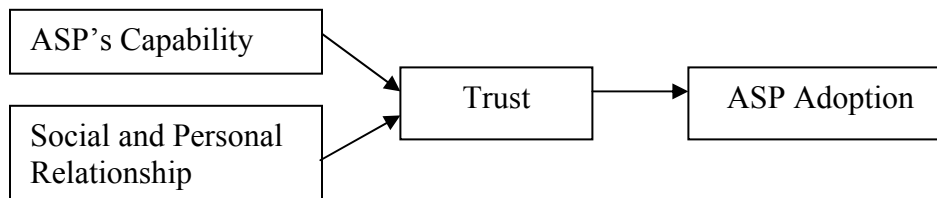
initialization and development between the two parties (Kern, 1997). However, since the ASP relationship is identified by high flexibility and economies of scale, the concept of a traditional strategic partnership may not be applicable to ASPs and their clients. Also, even partnerships sometimes fail in traditional IS outsourcing activities (McFarlan and Nolar 1995, Rai, Borah and Ramaprasad 1996). It is therefore necessary to investigate the impact of social relationships on initial ASP adoption from the standpoint of clients.

Trust is a core concept in social exchange theory. Trust has been identified as an essential element to develop a successful inter-organizational relationship (Karahammas and Jones, 1999; Williams, 1997). Anderson and Narus (1990) argued that trust is the belief that the other party has the willingness and ability to act in order to produce good results for both parties. Homans (1961) argued that trust will significantly influence the initialization and further development of the relationship between two parties. Kumar (1996) also stated that mutual trust can generate more profits, share more information, and make cooperation more flexible. In the ASP context, initial trust in the provider will considerably impact clients' intention to start the relationship with an external vendor (McKnight, 2001).

Research shows that several factors will influence the growth of trust between clients and vendors, such as personal and social bonds, and a vendor's capability (e.g., DiRomualdo and Gurbaxani, 1998). Kern (1997) argued that personal and social bonds are essential for building a client's initial trust in a vendor before establishing a formal contractual relationship with that vendor. A personal relationship between clients and an ASP will alleviate conflict and achieve continuing adaptation toward a final agreement (Lacity and Willcocks, 2001). For example, before Marriot became Statability's client, the managers had a close personal relationship with Statability's founder. This close relationship aided much in setting up the initial outsourcing deal.

While personal and social bonds are essential for building initial trust in an ASP, an ASP's capability shapes clients' initial trust in an ASP and further impacts the relationship between an ASP and its clients. Capabilities such as sufficiently powerful and secure servers, good understanding about a client's business, and experienced professionals form the basis for an ASP to deliver its promises (Koch, 2000).

Thus, it is proposed that clients will adopt the ASP business model based on their initial trust, acquired from both a personal relationship with an ASP and an ASP's capability (Figure 2-4). Here, due to possibility of model testing, this sub model cannot include all the factors which may impact the adoption decision from social perspectives, but can include only the most important factors in this initial stage of model development.



**Figure 2-4 Social determinants for ASP adoption**

## **2.2.4 Strategic Perspective**

IS research states that outsourcing has long been regarded as a strategic arrangement for a company (Lacity and Hirschheim, 1993; McLellan, et al., 1995; Insinga and Werle, 2000). Resource-based theory and resource-dependence theory form the strategic perspective of IS outsourcing. Resource-based theory focuses on a firm's internal resources and capabilities while resource-dependency theory examines external resources (Cheon, et al., 1995; Lee, et al., 2002).

### **2.2.4.1 Resource-based Theory**

Resource-based theory argues that a company is a set of resources. Barney (1991) classified these resources into three categories: physical capital, human capital, and organizational capital. He also argued that resources' heterogeneity and immobility will create competitive advantages for organizations. Heterogeneity of resources is the differences of resources from those of other companies. Immobility of resources means the difficulty and inability of other companies to obtain resources. Companies need to acquire heterogeneous and immobile resources that they lack internally but required in order to implement strategies. Barney (2001) further explored the position of resources-based theory of competitive advantages related to neo-classical microeconomics and evolutionary economics. By sharing the same or similar assumptions, resource-based theory provides a more comprehensive view about resource arrangements.

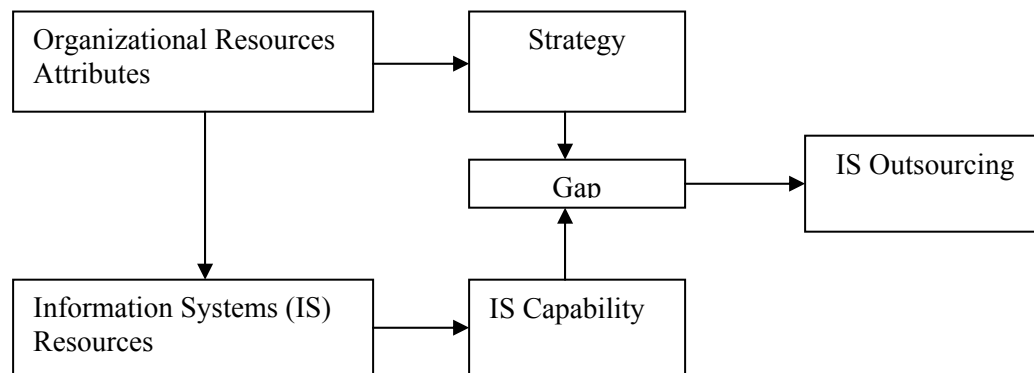
Conner (1991) and Grant (1991) used resource-based theory to study the role of resources in organizations' sustenance of continuous competitive advantages. The essence of resource-based theory is that a company should consider how to acquire and hold unique resources that are important to ongoing operations and productions, with the least investment (Conner, 1991). Most probably, in order for a company to achieve its strategic objectives, it is necessary to externally acquire resources to fill in the gap between current internal capabilities and the required abilities to reach strategic goals. Grant (1991) argued that resource management should not only examine the internally existing resources, but also develop and acquire more resources. By collaborating with an external vendor, a company can augment its current resource pool and extend its internal capability as well as gain more strategic opportunities. Moreover, Mahoney and Rajendran (1992) also stated that resource-based approaches should be viewed as "creative destruction and new combination of resources" to create strategic competition. These approaches include new method of production delivery as well as organizational innovation. Thus, outsourcing, as an organizational innovation, is motivated by growing management pressure to maintain or enhance competitive advantage with few internal resources at a fast pace (Insinga and Werle, 2000).

Currently, information technology is considered to be a strategic resource in most organizations (Cheon, et al., 1995; Grover, et al., 1998). Whether or not a company can maintain its competitive advantages depends directly on its IT capabilities. However, many companies lack the IT abilities needed to realize their goals, and they cannot wait for years to develop internal capabilities. According to resource-based theory, outsourcing is taken as a strategic arrangement to help a company compensate its IS capability deficiency. In this way, a company can get the necessary IS resources externally, including humans, machinery, and other supportive facilities, in order to achieve its strategic goals (Figure 2-5).

#### **2.2.4.2 Resource-dependence Theory**

In contrast to resource-based theory which examines internal resources, resource-dependence theory argues that all organizations, to some degree, have to depend on external resources for production (Pfeffer and Salancik, 1978). No firm can totally rely on its own resources to produce competitive products. To some degree, the efficiency of a company's

operations depends on its capability to acquire scarce resources needed for continuous production from external vendors.

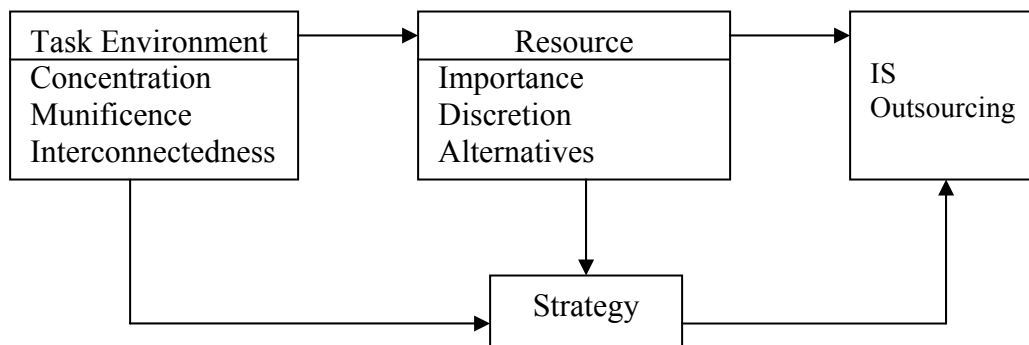


**Figure 2-5 Resource-based Theory (adopted from Crover, et al., 1998)**

Resource dependence theory argues that organizations will adopt certain strategies to secure acquisition of critical resources from the environment (Pfeffer and Salancik, 1978). This means maintaining powerful resources in-house and outsourcing weaker resources. After outsourcing its applications, a company will build a dependent relationship with other organizations. This dependence is greatly influenced by three resource dimensions: importance, discretion, and alternatives (Pfeffer and Salancik, 1978). The importance of resources to organizations is the extent to which the resources will influence continuous production. Discretion refers to a client's ability to be aware of and control resource availability. Alternatives mean a client's flexibility to switch to another vendor. By combining all these considerations together, a company will assess the dependence associated with outsourcing to make the outsourcing decision.

Grover et al. (1998) further argued that resource-dependence theory provides a useful perspective to examine the impact of IS outsourcing decision on organizational operation efficiency. The same three resource dimensions also exist in IS applications and influence a client's decision about IS outsourcing. Research has explored the impact of these factors on outsourcing decisions. Insinga and Werle also (2000) recommended keeping in house the applications that will potentially yield competitive advantages to a company. When clients can have a certain control on their dependence upon a vendor or easily find other alternatives, they

are more likely to acquire IS resources externally (Grover, et al., 1998). Resource-dependence theory is illustrated in Figure 2-6.



**Figure 2-6 Resource-dependence Theory (adopted from Grover et al., 1998)**

These two strategic theories (resource-based theory and resource-dependence theory) provide a framework for clients to examine critical internal and external resources when making an outsourcing decision (Grover, et al., 1998, McLellan, et al., 1995). In the context of ASP, the resource-based theory can be used to explain the effect of IT deficiency and the resource-dependency theory can be used to explain application importance upon clients' attitudes toward the ASP adoption.

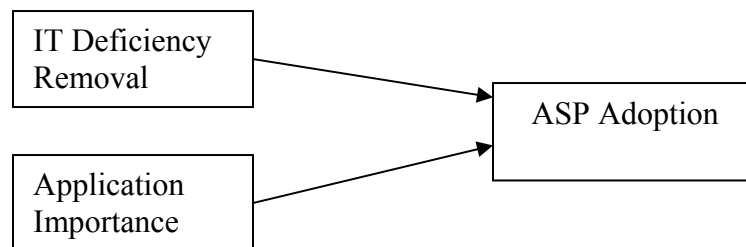
IT deficiency between a client's internal capability and strategic demands is a strong motivation for outsourcing (McLellan et al., 1995; Kern et al., 2002). IS managers are under the great pressure of effectively accessing new technology and maintaining competitive advantages (Insinga and Werle, 2000). However, most ASPs' clients lack a strong internal IT capability to leverage their business value. In addition, as skillful IT professionals are still in short supply, it is hard for small and medium-sized enterprises (SME) with very tight IT budgets to hire and retain these eligible professionals. Currently, even large companies also face the economic pressure to cut IT costs (TripleTree, 2003). So, it is an attractive idea to adopt an ASP in order to gain strategic advantages over other competitors.

Application importance is another essential factor affecting clients' dependence on an ASP. Based on hundreds of case studies, Willcocks and Lacity (2001) found that application importance will increase the dependence of clients on an outsourcing vendor, when clients want to outsource critical applications. The high dependence will deter the clients' outsourcing

intention. Based on several cases studies, Kern and Willcocks (2002) also stated that too much dependence on a vendor's performance was ranked as a high risk in outsourcing activities. Core applications are always recommended for in house development (Lacity and Hirschheim, 1993; Insigna and Werle, 2000). However, the short length of an ASP's contract, predictable monthly fees, and nearly nil investment on the clients' side can offset the deterrence caused by application importance. Thus, in the context of ASP, the relationship between application importance and the ASP adoption decision deserves reexamination.

In addition to application importance, there are two other factors of resource-dependence theory, discretion and alternative. However, these two factors are not included in this study. Discretion is not very critical in this study because in the context of ASP, applications are generally standardized (Susarla, et al., 2003). In this study, clients' concerns about resource stabilization and accessibility have been measured by ASP capability from the social perspective. Moreover, the effect of alternatives can be better represented by asset specificity, since high asset specificity means few alternatives.

Thus, from the strategic perspective, companies will evaluate their internal resources and externally gain critical capabilities to satisfy strategic requirements. IT deficiency and application importance are two important factors influencing clients' attitudes towards ASP adoption. Figure 2-7 illustrates the relationships. Here, due to the possibility of model testing, this sub model cannot include all the factors from the strategic perspective which may impact the adoption decision, but can include only the most important factors in this initial stage of model development.



**Figure 2-7 Strategic determinants for ASP adoption**

Economic, strategic, and social theories provide a valuable theoretical framework to examine ASP adoption. Since each theory can only explain the ASP adoption decision from its unique view, it is necessary to combine all the important determinants from economic, strategic and social perspectives together. Besides playing an individual role in ASP adoption respectively, these determinants also have relationships among each other. It is worthwhile to scrutinize further the moderating effects among these three categories of factors in the context of ASP.

Based on the theoretical foundations discussed in this chapter, the next chapter presents an integrative ASP adoption decision model that combines these three perspectives to investigate various factors influencing clients' ASP adoption decision. Each construct in the proposed model is discussed and associated hypothesizes are formulated to test the model.



## **CHAPTER 3 RESEARCH MODEL AND HYPOTHESES**

This chapter presents a conceptual model that integrates three outsourcing perspectives in order to study the key factors that influence the ASP adoption decision for a company. This integrative model is illustrated in Figure 3-1. The three perspectives are described as: 1) the economic perspective which suggests that uncertainty, asset specificity and cost benefit are determining factors; 2) the strategic perspective which suggests that application importance and IT deficiency removal are determining factors; and 3) the social perspective which suggests that ASP's capability, social and personal relationships, and trust are determining factors. This research model also suggests that the factors associated with these three perspectives will work both individually and interactively to influence the ASP adoption decision.

This model was developed specifically to be applicable to the adoption decision for all types of ASPs, and it is therefore intended to be a general model. The model is intentionally restricted to a certain number of factors from a certain number of perspectives in order to keep this study manageable, particularly from a data analysis perspective. The results from this study provide an important direction for future research.

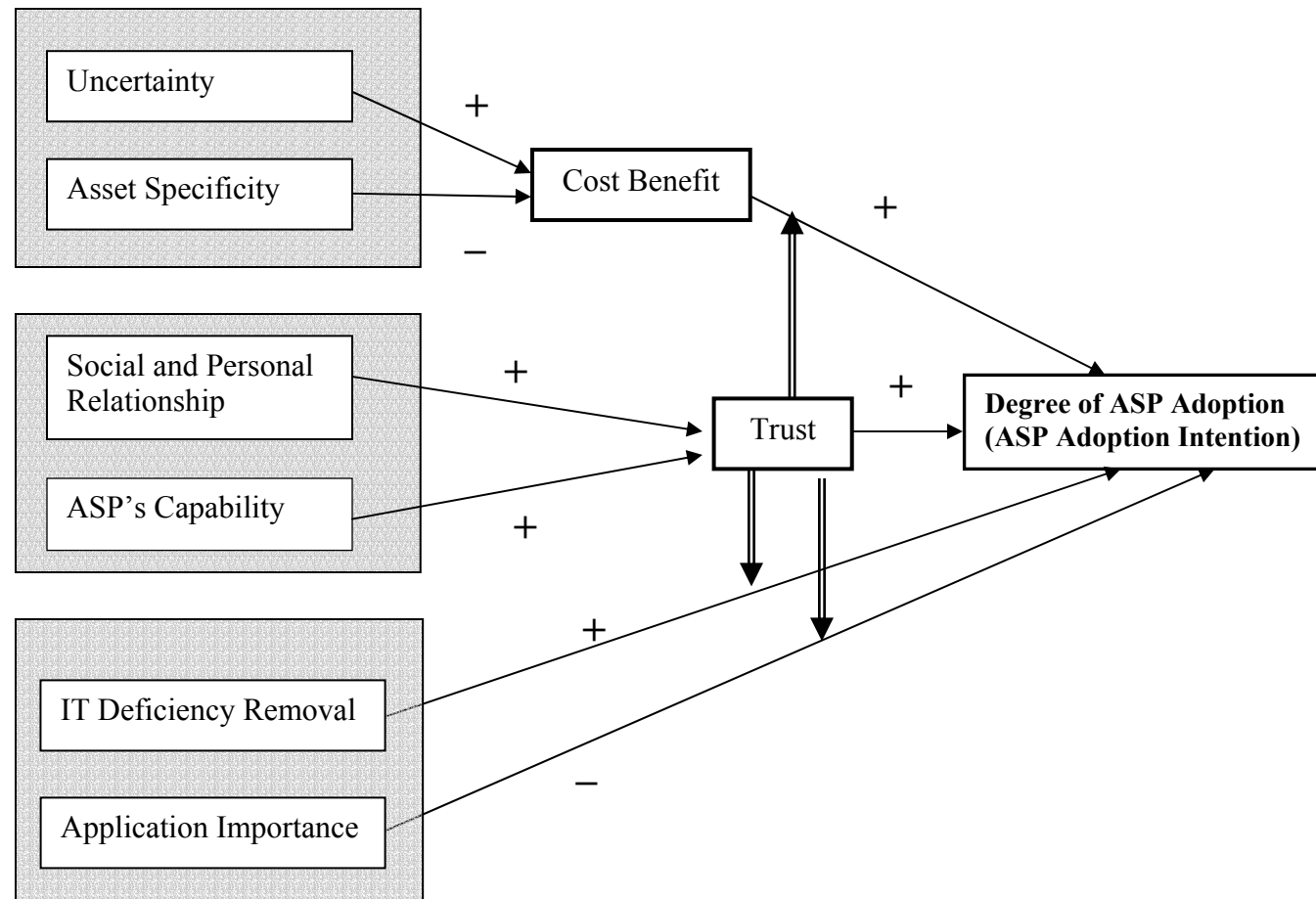
In the following section, the determining factors discussed above, their interactions, and their associated hypotheses are presented and further elaborated.

### **3.1 Impact from the Three Perspectives**

#### **3.1.1 Economic Perspective**

From the economic perspective, uncertainty, asset specificity, and cost benefit are expected to be important factors of the ASP adoption decision.

**Uncertainty**, in this study, refers primarily to change associated with the external environment, that is, change associated with market, technology, economy, and industry. Williamson (1975) argued that as the environment grows increasingly turbulent, transaction costs will tend to rise. Market turbulence could be caused by radical change in consumer preference.



**Figure 3-1 ASP adoption decision model**

Turbulence associated with technology could be caused by technological innovations that are adopted by competitors. Economic turbulence could be triggered by increased global competition or export policy. Turbulence associated with industry could be caused by policy associated with anti-trust, for instance. Miller and Friesen (1982) found that environmental uncertainty influences an organization's strategies on production and process innovation. Nam, et al., (1996) also emphasized the significant role that environmental uncertainty plays in IT investment decisions.

Williamson (1985) further suggested that as environmental uncertainty increases, companies will be less willing to take risks. In other words, companies would be more likely to minimize their dependency on external vendors since traditional outsourcing typically involves some level of risk. However, reducing dependency on external vendors will require the company to rely more, hence to invest more, on their own internal infrastructure. The costs associated with maintaining greater infrastructure capabilities are generally high, that is, internal production costs are greater and likely to be significant.

Jensen and Mecking (1976) further emphasized, in the context of traditional outsourcing, that environmental turbulence will result in higher costs associated with sustaining the external vendor relationship. Again, these costs would be associated with vendor evaluation, contract negotiation, and performance monitoring. These costs and associated risks could dissuade companies from seeking outsourcing opportunities.

The ASP business model leverages networked economies (referring to Applegate, 2003) to provide a flexible application solution to vendors. The ASP business model is driven by relatively short contract periods and simple pricing models (e.g., monthly usage rate). Therefore, the notion of "dependency" of client on vendor is not as significant as many of the traditional outsourcing studies indicate. Shorter contract lengths also tend to force ASPs to pay more attention to service quality (Lacity and Willcocks, 2001).

Furthermore, in a dynamic and competitive environment, companies must focus resources on those activities that distinguish them from their competitors. Slaughter and Ang (1996) suggest a company should focus the internal IS resources on their strategic applications (referred to as core applications) and to outsource to a vendor those applications that are not

strategic (e.g., operational applications, referred to as non-core applications). By doing so, a company can sustain high levels of organizational flexibility that are essential in a dynamic and competitive environment.

The ASP business model tends to provide companies with organizational flexibility since certain administrative activities (software upgrades and version management, and technical support) associated with providing specific applications by the ASP are no longer the responsibility of the company. By moving some applications outside the company, many organizations realize associated cost savings (TripleTree, 2003).

Thus, in an environment experiencing significant uncertainty, an ASP effectively can relieve many constraints associated with a company's internal production, thereby resulting in cost savings. Hence, it is hypothesized that there is a positive relationship between uncertainty and cost benefits associated with ASP adoption:

Hypothesis 1: A higher level of environmental uncertainty will lead to greater cost benefits associated with ASP adoption.

**Asset Specificity** refers to the uniqueness of products and services clients require from an ASP. Zaheer and Venkatraman (1995) classified asset specificity into two categories: human asset specificity and procedural asset specificity. Human asset specificity is defined as the extent to which the experience and expertise of professionals are required to meet special demands of the client. Procedural asset specificity is the extent to which the applications provided by an ASP are customized, thereby making them suitable only for the specific requirements of that particular client. Ang and Straub (1998) further defined software and hardware asset specificity as procedural asset specificity. They particularly refer to the degree of software and hardware uniqueness that is necessary for an ASP to support the company's application.

By definition, applications that require significant customization are high in asset specificity. Highly customized applications require significant investment in hardware and/or software and, in many cases, application design and configuration. An ASP with a wide set of applications would have a hard time realizing benefits associated with economies-of-scale by delivering applications that cannot be easily transferred to other enterprises (Grover, et al.,

1996). Therefore, when asset specificity is high, ASPs may require extended contract terms or may set higher prices in order to be compensated for this added liability.

For example, Statability, an ASP providing reporting services for the hospitality industry, will only agree to significant application customization for renewed clients with an extended contract length – typically more than three years (Statability, 2002). Hence, a company will generally sacrifice either economic benefit or contract flexibility in exchange for asset specificity. Customization of applications also tends to consume more resources to determine the optimal configuration and to negotiate the customization itself. Thus, high asset specificity tends to increase transaction costs.

Also, with high asset specificity come high switching costs. This makes it more difficult for a company to switch to another ASP. If an application is unique, there will be fewer ASPs that could possibly offer the application since there are fewer ASPs who either have the necessary capability or willing to invest necessary resources to obtain this capability. There are therefore fewer alternatives for switching to another ASP without additional costs. Thus, clients are likely to be bound in a relationship with a specific ASP (Rokkan, et al., 2003).

In contrast, Grover, et al., (1994) suggest that it is more efficient to produce applications high in asset specificity internally since the company will better understand the specific business requirements. Also, the company would experience efficiencies due to more effective communication and project management. This would suggest that a higher level of asset specificity would require higher production costs. But it is assumed that these cost increases will actually be lower than those costs that would be associated with external hosting.

Hence, in regards to internal application production costs, the cost benefits provided by the ASP business model would decrease as the uniqueness of the application increases.

It is hypothesized that:

Hypothesis 2: A higher level of asset specificity will lead to less cost benefits associated with ASP adoption.

**Cost Benefit** refers to the cost advantage when comparing internal production costs (material, labor, and time) associated with not adopting an ASP, to the external costs associated with adopting an ASP (Ang and Straub, 1998; Jayatilaka, et al., 2003). A positive cost benefit results when the external hosting costs due to ASP adoption are less than the internal production costs due to not adopting an ASP.

In order to determine whether there is a positive cost benefit for adopting an ASP, a company should estimate the external costs associated with the adoption. The estimation of external costs represents all of the external cost elements associated with the ASP adoption life cycle. Such costs include the set-up fee, subscription fee, and cost of negotiation at the beginning of the adoption process. Costs associated with monitoring, conflict resolution, and contract renewal negotiations also should be taken into account (Lacity and Willcocks, 2001).

Similarly, the company should estimate costs associated with internal development, continuous maintenance, and updates, such as material, labor, and time. Comparative costs of internal production and the price to get the same service from an ASP will impact the company's ASP adoption decision (Saarinen and Vepsäläinen, 1994).

Ang and Straub (1998) confirmed through an empirical study that greater cost benefits associated with IS outsourcing resulted in a higher level of IS outsourcing in the banking industry. Kern, et al., (2002b) argued that predictable monthly fees are the principal advantage of the ASP business model. Jayatilaka, et al., (2003) reported that the low costs associated with the ASP business model is cited as the key reason for companies to adopt the ASP, although it is also observed by Kern, et al., (2002b) that not many ASP clients have actually realized significant cost reductions through ASP adoption.

Thus, it is hypothesized that:

Hypothesis 3: Perceived higher cost benefits associated with ASP adoption lead to a higher degree of ASP adoption.

### **3.1.2 Social Perspective**

From the social perspective, outsourcing applications to an ASP is not a one-time transaction but involves an ongoing relationship. To initialize the relationship and keep the

relationship going forward smoothly, it is necessary for a vendor to gain the trust of a client (Kern, 1997). In this study it is proposed that a company's trust is influenced by both social and personal relationships between the company and the ASP. In addition, this study proposes that a company's trust is influenced by the company's perception of ASP's capability.

**Social and Personal Relationship** refers to an informal relationship between one or more individuals at the client company with one or more individuals at the ASP. These relationships are developed prior to the agreement through normative exchange (Kern, 1997) and will generally evolve over time. A more positive, familiar relationship between managers at the two companies can strengthen their trust in each other (Rogers-Gillmore, 1987). As individuals in a relationship tend to learn more about each other and better understand each other, their trust in each other tends to enhance (Blois, 1999).

In this way, social networks would help to alleviate problems that could occur through misunderstandings or a lack of trust and thereby would accelerate the contractual relationship between two companies (Rangan, 2000). All things being equal, a strong social and personal relationship level should favorably influence the ASP adoption decision. In fact, the personal relationship between high-level managers has been cited by most CEOs as a major mechanism in building inter-organizational trust and subsequently strengthening the business relationship (Henderson, 1990).

It is further observed through discussion with two ASP CEOs that many ASPs form their initial group of clients from the ASP's founders' broad personal network within a target industry (Thompson, 2003; Wohl, 2003). In this case, the reputation of those ASPs is also partially based on their founders' personal popularity in an industry. For instance, the founder of Network Technology Group (NTG), an ASP principally serving law firms, has worked in a law firm for over twenty years (NTG, 2002). His personal relationship with clients helped NTG win contracts early in its development. Gwinner, et al., (1998) suggest clients assume that the ASPs with whom they are personally related will give them a better price arrangement and a higher quality of service. Rangan (2000) suggests that a broad social and personal relationship provides clients with more opportunities to assess an ASP's capabilities prior to committing to a contractual relationship with that ASP.

It is hypothesized that:

Hypothesis 4: A closer social and personal relationship between managers of an ASP and their client will lead to higher levels of trust in the ASP.

**ASP Capability:** Generally speaking, an ASP's capabilities can be classified as business capabilities and technological capabilities.

Business capabilities refer to knowledge of the clients' business requirements, such as industry standards, processes and terminologies, business objectives, organizational structures, and management processes (Lee and Kim 1999). Business capabilities are closely associated with the skills of ASP professionals (Swinarski, Kishore and Rao, 2001).

Technological capabilities refer to the ASPs' ability to deliver promised applications and provide 24/7 support and timely version upgrades, as well as ensure the security of data transfer and storage. Frequent network disruption or compromised data integration may seriously damage a client's trust in an ASP's capabilities. This would then lead to a less favorable ASP adoption decision (Paraskevas and Buhalis, 2002).

DiRomualdo and Gurbaxani (1998) regarded the capability of a general vendor as a critical factor in the vendor-client relationship. The perception that a vendor is capable of delivering as promised is essential for a client to build trust in a vendor (Anderson and Narus, 1990). It would then seem that prospective clients who lack extensive IT experience may tend to rely more on these indicators of the vendor's capability. One report suggests (The Phillips Group InfoTech, 2000) that indicators of ASP capability could include endorsements by major vendors, measures of an ASP's size and coverage, ASP's partnership alliances with software, hardware, or telecommunication vendors, and an ASP's financial security. Beatty, et al., (1996) suggest that clients' trust in a vendor will increase when they have a high perception of the vendor's capability, even without having actual working experiences with the vendor.

Hence, it is hypothesized that:



Hypothesis 5: A perceived higher level of ASP capability will lead to a higher level of trust towards the ASP by the ASP client.

**Trust:** Williamson (1983) classified trust into three categories: cumulative, personal, and institutional. Cumulative trust refers to a rational form of trust caused by self-interest and reputation. Personal trust occurs between individuals. Institutional trust occurs among organizations. In this study, trust refers to trust at the institutional level. Anderson and Narus (1990, p. 450) defined trust as a “firm’s belief that another company will perform actions that will result in positive outcomes.” To be more specific, in this study, the definition of trust is presented by Morgan and Hunt (1994) as clients’ belief that a vender has both the intention and ability to provide quality services. This basic trust between organizations forms the basis of their business relationship.

Marketing relationship research supports the idea that trust plays a critical role in establishing and developing an inter-organizational relationship (Moore, 1998; Morgan and Hunt, 1994). For example, Lee and Kim (1999) found that high levels of trust between two organizations tend to drive clients strongly to initiate cooperation with a vendor and may even lead to further outsourcing success. A higher level of trust between two parties also will likely improve relationship development through more effective communication and conflict resolution. Undoubtedly, clients will be more likely to entrust more of their applications to an ASP that they trust. Kern, et al., (2002a) confirmed that the ability to build a trusting relationship and avoid relational trauma is imperative for outsourcing success.

Hence, it is hypothesized that:

Hypothesis 6: A higher level of trust between the ASP and the ASP client will result in a higher degree of ASP adoption.

### **3.1.3 Strategic Perspective**

From the strategic perspective, it is argued that IT deficiency removal and application importance are two critical factors influencing ASP adoption decisions.

**IT deficiency removal** is the extent to which an organization needs to acquire external IT resources to support strategic or operational requirements (Grover, et al., 1998). In this study, external resources generally refer to IT application expertise. IT deficiency can be measured by gaps between the expectation and perception of clients' resources and capabilities (Grover, et al., 1994). In this study, three categories of deficiency are identified: 1) IS investment, 2) IS knowledge, and 3) IS staff. IS investment refers to the capital required to establish infrastructure, such as hardware and software. IS knowledge refers to the knowledge needed to provide quality services, such as effective data gathering and timely trouble shooting. IS staff deals with the capabilities and size of the IS staff.

Early in the development of the ASP business model, the client base generally targeted by ASPs was small and medium-sized enterprises (SME) that lacked specific investment, knowledge, and professionals in IT. Currently, even large companies may not have sufficient knowledge of some specific applications, particularly in emerging areas, and likely be ASP clients. It is often found, when ASPs engage in the early stages of a relationship, they find that significant knowledge asymmetry exists between clients and ASPs (Yao, 2002).

Companies often find integration and innovation to be two essential strategic objectives (Quinn and Hilmer, 1994; McFarlan and Nolan, 1995). Outsourcing applications to an ASP may be a good opportunity to achieve systems integration, such as acquiring online ERP applications or data warehousing applications. ASP outsourcing may also provide access to the newest technology and subsequently shorten the time of getting a client's products to the market (Yang and Huang, 2000).

Hence, it is hypothesized that:

Hypothesis 7: As the perceived ability of an ASP to eliminate a client's IT deficiency increases, the degree of ASP adoption increases.

**Application Importance:** Application importance refers to the relative importance of an application in an organization, whether strategic or operational (Grover, et al., 1998). Deficiencies in such applications will significantly damage a company's performance at either

strategic or operational levels. Lee, et al., (2002) suggests that the most important application, considered to be critical IS resources for gaining competitive advantages, should be produced in-house.

Ang and Straub (1998) found that most banks can outsource some of their important applications, such as online transactions, but not others such as the internal clients' account process. Some researchers use ERP systems hosting as evidence to argue that critical applications can be outsourced online (Chen and Soloman, 2002). The most popular ERP application being outsourced today seems to be the human resource module, although this is difficult to confirm. Seldom will companies outsource the financial module or the core production planning module. Another example here is online payroll processing, a very common application outsourced to ASPs. Relatively speaking, such an application is not typically a high-priority application in an organization. These practical examples show that the degree of application importance may influence the extent of ASP adoption. In a dynamic environment, clients need to focus on their core competencies to maintain competitive advantages and consider outsourcing the rest of the applications to gain flexibility (Slaughter and Ang, 1996).

McFarlan and Nolan (1998) identified two types of application importance: operational importance and strategic importance. The applications of operational importance are associated with real-time and reliable information access and processing. The applications of strategic importance are associated with innovation and competitive advantage. They argue that activities with strategic importance should not be outsourced in order for clients to safeguard their competitive advantage. Even though operational activities outsourcing has been found to be attractive in the past, the authors believe that a company should avoid depending too much on external vendors.

Thus, it is hypothesized that:

Proposition 8: A higher level of application importance will result in a lower degree of ASP adoption.

### 3.2 Moderating Relationship

Although economic and strategic factors individually affect the ASP adoption decision, trust should have a moderating effect on their respective impacts.

Kern suggests (1997) that increasing a company's initial trust towards an ASP vendor could reduce the efforts required to reach an ASP adoption decision. In effect, this would alleviate certain economic determinants. Zaheer and Venkatraman (1995) argued that trust established before a formal contractual relationship can reduce external transaction costs. Higher levels of trust can result in lower monitoring costs and performance evaluation costs by reducing the frequency and labor required for monitoring. Therefore, trust can reduce the external costs of an ASP and enhance the clients' cost benefits. Moreover, a client could be inclined to sacrifice a cost benefit by choosing a vendor that the client has trust in. For example, most clients may choose IBM with its higher price because they trust that IBM will provide services of the best quality.

In addition, when clients trust that an ASP will perform properly and generate positive results in their interests, the ASP clients may outsource products with high asset specificity to their ASP. Furthermore, if an ASP client has a strong degree of trust in its ASP, the client will believe that the ASP will do its best to protect clients' interests, even when the environment is uncertain. Thus, even if the cost benefits are not significant, the clients may still choose to adopt that ASP.

It is hypothesized that:

Hypothesis 9: Trust will moderate the relationship between cost benefits and the degree of ASP adoption such that when trust is high there is a less positive relationship between cost benefits and the degree of ASP adoption than when trust is low.

Similarly, trust should tend to influence the relationship between strategic factors and the degree of ASP adoption. In the case of application importance, clients' strong trust in an ASP can boost clients' confidence regarding sensitive data (Lacity and Willcocks, 2001). For example,

Marriott Corporation provides its sales information to Statability for online reporting applications, in large part due to the fact that the founders of Statability have maintained a very close personal relationship with Marriott for many years (Statability, 2002). Thus, clients can lease more important applications with more sensitive data transfer from a trustworthy ASP. With trust, the ASP adoption process will generally run smoother as clients believe that their trusted ASP will best serve their interests (Dyer and Singh, 1998).

Trust tends to increase ASP clients' confidence that the ASP will "go the extra mile" to deliver high quality products and services to meet their specific requirements (Ganesan, 1994). Consequently, in order to alleviate their internal IT deficiencies, clients are more willing to collaborate with trustworthy vendors (Blois, 1998), even though this collaboration may require the clients to depend heavily on the vendors. A higher level of trust in the vendors should generally offset, or alleviate, many of the concerns regarding its high level of dependency.

Hence, it is hypothesized that:

Hypothesis 10a: Trust will moderate the relationship between application importance and the degree of ASP adoption such that when trust is high, there is a less negative relationship between application importance and the degree of ASP adoption than when trust is low.

Hypothesis 10b: Trust will moderate the relationship between IT deficiency removal and the degree of ASP adoption such that when trust is high, there is a more positive relationship between IT deficiency removal and the degree of ASP adoption than when trust is low.

### **3.3 Dependent Variable**

In general, ASPs deal with two types of companies: those that have adopted the ASP business model to some degree, referred to as current ASP clients, and those that have not adopted the ASP business model at all, referred to as non current ASP clients. Current ASP

clients have made adoption decisions while non-current ASP clients have not adopted the ASP business model to date. It is assumed in this study that non-current ASP clients may include those that have rejected the ASP business model in general, and those that have not rejected the ASP business model but also have not made a favorable ASP adoption decision to date.

However, no matter which stage of ASP adoption they are in, these general factors from the three perspectives need to be considered by both current ASP clients and non-current ASP clients when they evaluate the ASP business model. Hence, the integrated ASP adoption decision model should be applicable to both current and non-current ASP clients.

Moreover, as current clients have already adopted ASPs, it may be more valuable to examine their desired or actual degree of ASP adoption. Meanwhile, as non-current ASP clients have not adopted the ASP business model yet, it would be more meaningful to study their intention to adopt. Thus, in this research model, the dependent variable will depend on the specific type of client studied. Two dependent variables are employed in this dissertation study: the degree of ASP adoption is used for current ASP clients, and ASP adoption intention is used for non-current ASP clients.

**The degree of ASP adoption** refers to the extent to which a company actually outsources its internal applications to an ASP. Degree of ASP adoption indicates the actual behaviors of outsourcing. It objectively evaluates the impact of the determinants of ASP adoption by assessing real decisions.

The degree of ASP adoption construct can be measured from three perspectives: operational, functional, and financial. The operational perspective refers to the way IT applications are managed, from partial IT functions outsourcing to total ASP adoption (Ang and Straub, 1998). The functional perspective refers to the scope of applications outsourced to an ASP (Ang and Straub, 1998). For example, such applications could include finance and accounting, human resource management, client relationship management, sales force support, manufacturing and logistics, supply chain management, e-commerce solutions, office automatics, messaging, and collaboration services such as e-mail (Kern, et al., 2002b). The financial perspective examines the extent of ASP adoption from the point of view of a financial investment. Specifically, one may look at how much of the total application portfolio value (i.e.,

the value of the IS functions) is outsourced to an ASP relative to the total value of the organization's IT application portfolio.

**ASP adoption intention** refers to a company's perceived intention to outsource applications to an ASP. Factors from economic, strategic, and social perspectives will impact clients' intention to adopt the ASP business model.

The similar measurements from the above three perspectives - operational, functional and financial - are modified and used for this construct. Among non-current ASP clients, the operational perspective refers to the intended way by which IT applications are managed in a company, from partial IT functions outsourcing to total ASP adoption. The functional perspective refers to the scope of applications that are intended to be outsourced to an ASP. The financial perspective examines the extent of ASP adoption intention from the point of view of a financial investment. Specifically, it looks at how much of the total application portfolio value i.e., the value of the IS functions) is intended to be outsourced to an ASP (relative to the total value of the organization's IT application portfolio. In addition, three other questions using likert-scale were also adopted to assess the overall intention to adopt the ASP business model, regarding general intention, the amount of outsourcing application, and the time issue. The question about the general intention assesses the likelihood that a company will adopt the ASP business model for at least one application. The question about the amount of application assesses the likelihood that a company will outsource most applications to an ASP. The question about the time issue assesses how soon a company is going to use an ASP.

These six questions together are used to measure a company's intention to adopt the ASP business model. Though Davis (1989) and other studies (e.g. Taylor and Todd, 1995; Venkatesh and Davis, 2000) showed that positive intention may or may not result in actual behaviors, it is still valuable to understand the potential possibility that a company will adopt the ASP business model, as stronger intention has higher probability to cause an adoption action.

The operational definitions of the factors and key literature used to develop the model presented here are summarized in Table 3-1.

**Table 3-1 Summary of constructs and relative literatures**

<b>Factors</b>	<b>Operational Definition</b>	<b>Relative Literatures</b>
Degree of ASP adoption	The extent to which a company actually outsources its internal applications to an ASP	Ang and Straub (1998) Crover, et al., (1994)
ASP Adoption Intention	A company's perceived intention to outsource applications to an ASP	Davis (1989) Ang and Straub (1998) Crover, et al., (1994)
Uncertainty	The change associated with the external environment, including change associated with market, technology, economy, and industry.	Miller and Friesen (1982) Jensen and Meckling (1976) Williamson (1985) Zaheer and Venkatraman (1995) Ang and Cummings (1997)
Asset Specificity	The degree of uniqueness of human skill and expertise, and technical infrastructure (software and hardware) required to deliver the client's functions.	Williamson (1975, 1985) Grover, et al. (1996, 1998) Zaheer and Venkatraman (1995) Ang and Straub (1998)
Cost Benefits	The cost advantage when comparing internal production costs (material, labor, and time) associated with not adopting an ASP, to the external costs associated with adopting an ASP	Ang and Straub (1998) Kern, et al. (2002) Jayatilaka, et al. (2003)
Social and Personal Relationship	An informal relationship between one or more individuals at the client company with one or more individuals at the ASP	Cook (1987) Henderson (1990) Kern (1997)
Capability	The degree to which the ASP has the business ability to understand a client's business standards, requirements, and business process, and the technological ability to provide updated applications continuously, and to ensure the security of data transfer and storage.	Ganesan (1994) Lee and Kim (1999) Swinarski, Kishore, Rao (2001)
Trust	The degree of a client's belief that an ASP has the benevolence and capability to provide its promised services.	Anderson and Narus (1990) Morgan and Hunt (1994) Ganesan (1994), Blois (1999) Lee and Kim (1999)
IT Deficiency Removal	The extent to which an organization needs to acquire external IT resources to support strategic or operational requirements. The external IT resources include IS investment, IS knowledge, and IS staff.	Groven, et al., (1994) Dibbern (2000)
Application Importance	The relative importance of an application in an organization, whether strategic or operational	Pfeffer and Salanick (1973) Earl (1996) Goo, et al., (2002)

In this section, specific hypotheses are formulated in order to empirically test the research model. A total of 11 hypotheses were derived above, assuming “degree of ASP adoption” as the dependent variable. These hypotheses need to be tested among current ASP clients. They are summarized in Table 3-2.



**Table 3-2 Research hypotheses for current ASP clients**

<b>Number</b>	<b>Hypothesis</b>
H1	A higher level of environmental uncertainty will lead to greater cost benefits associated with ASP adoption.
H2	A higher level of asset specificity will lead to less cost benefits associated with ASP adoption.
H3	Perceived higher cost benefits associated with ASP adoption lead to a higher degree of ASP adoption.
H4	A closer social and personal relationship between managers of an ASP and their client will lead to higher levels of trust in the ASP.
H5	A perceived higher level of ASP capability will lead to a higher level of trust in the ASP.
H6	A higher level of trust between the ASP and the ASP client will result in a higher degree of ASP adoption.
H7	As the perceived ability of an ASP to eliminate a client's IT deficiency increases, the degree of ASP adoption increases.
H8	A higher level of application importance will result in a lower degree of ASP adoption.
H9	Trust will moderate the relationship between cost benefits and the degree of ASP adoption such that when trust is high, there is a less positive relationship between cost benefits and the degree of ASP adoption than when trust is low.
H10a	Trust will moderate the relationship between application importance and the degree of ASP adoption such that when trust is high, there is a less negative relationship between application importance and the degree of ASP adoption than when trust is low.
H10b	Trust will moderate the relationship between IT deficiency removal and the degree of ASP adoption such that when trust is high, there is a more positive relationship between IT deficiency removal and the degree of ASP adoption than when trust is low.

When this model is tested among non-current ASP clients, the dependent variable becomes ASP adoption intention. Thus, the 11 hypotheses should be phrased slightly differently. They are summarized in Table 3-3.

In the following chapter, the research methodology, including both quantitative and qualitative techniques, is justified. Then the studies that are used to address the research questions and test the research model are discussed in detail.

**Table 3-3 Research hypotheses for non-current ASP clients**

<b>Number</b>	<b>Hypothesis</b>
H1	A higher level of environmental uncertainty will lead to greater cost benefits associated with ASP adoption.
H2	A higher level of asset specificity will lead to less cost benefits associated with ASP adoption.
H3	Perceived higher cost benefits associated with ASP adoption lead to a <b>higher level of ASP adoption intention</b> .
H4	A closer social and personal relationship between managers of an ASP and their client will lead to higher levels of trust in the ASP.
H5	A perceived higher level of ASP capability will lead to a higher level of trust in the ASP.
H6	A higher level of trust between the ASP and the ASP client will result in a <b>higher level of ASP adoption intention</b> .
H7	As the perceived ability of an ASP to eliminate a client's IT deficiency increases, <b>the ASP adoption intention</b> increases.
H8	A higher level of application importance will result in a <b>lower level of ASP adoption intention</b> .
H9	Trust will moderate the relationship between cost benefits and <b>the of ASP adoption intention</b> such that when trust is high, there is a less positive relationship between cost benefits and <b>the ASP adoption intention</b> than when trust is low.
H10a	Trust will moderate the relationship between application importance and <b>the ASP adoption intention</b> such that when trust is high, there is a less negative relationship between application importance and <b>ASP adoption intention</b> than when trust is low.
H10b	Trust will moderate the relationship between IT deficiency removal and <b>the ASP adoption intention</b> such that when trust is high, there is a more positive relationship between IT deficiency removal and <b>the ASP adoption intention</b> than when trust is low.

## **CHAPTER 4 RESEARCH DESIGN AND DATA COLLECTION**

In the last chapter, the ASP adoption decision model that integrates economic, strategic, and social perspectives was presented. In this chapter, the research design and data collection are addressed in detail.

This study employs quantitative techniques to investigate the factors impacting the ASP adoption decision in an organization. It includes the collection and analysis of survey data from two sources for hypotheses testing. The first data source consists of the clients of a leading ASP in the lending industry. The second data source consists of a randomly selected sample of top computing executives from throughout the United States. In addition, some case interviews are also conducted regarding a large public university that has recently decided to utilize an ASP who provides online education systems. The results from these interviews help to understand the insight of ASP adoption decision process, to clarify the constructs and evaluate questionnaires, and to assist in explaining findings of the survey.

In this chapter, the general methodology adopted for this study is justified. The following items associated with each study are then addressed respectively: research method justification, sampling, instrument development, data collection procedures, and data analysis strategies.

### **4.1 General Research Methodology**

The purpose of research methodology is “discovery.” Discovery is noted to be “anything related to the creation of new theories or interpretive applications, including anything related to adopting novel approaches to measurement, inventing or uncovering new constructs, or inventing or uncovering original theoretical perspectives from which to view organizational phenomena” (McCall and Bobko, 1990). Good research methodology can help researchers understand internal problems and test theories. However, all research methodologies inherently have some disadvantages in some respect (Dennis and Valacich, 2001). Thus, combining several

research methods may increase the rigorousness of a study, as these different methods can compensate for each other and enhance one another's strengths (Kaplan and Duchon, 1988).

In scientific research, qualitative and quantitative methodologies are two principal ways to make discoveries. Qualitative research has a long, distinguished history in the human and social science disciplines (Denzin and Lincoln, 1998). Qualitative research is “a multi-method in focus, involving an interpretive, naturalistic approach to its subject matter” (p.3). It attempts to study things in their natural settings and interpret the meanings humans bring to them. Qualitative studies can provide researchers with rich descriptions and help them gain a comprehensive understanding of the socially structured nature of reality by building an intimate relationship between researchers and what they studied, capturing the individual's point of view, and examining the constraints of everyday life (Denzin and Lincoln, 1998). Examples of the qualitative method include case study, action research, and ethnography.

Quantitative research “emphasizes the measurement and analysis of causal relationships between variables, not processes” (Denzin and Lincoln, 1998, p.8). It is most often used in positivist studies to objectively test hypotheses or to test models that are built based on theories (Kaplan and Duchon, 1988). It is a robust and systematic way to examine and measure developed research models significantly (Denzin and Lincoln, 1998). The most common examples of quantitative methods include survey, laboratory and field experiments, and mathematics modeling (Shadish, et al., 2002). Various statistical analyses provide powerful tools for researchers to find “objective reality” (Lee, 1991, p.343).

Based on the foregoing discussion, it is obvious that qualitative and quantitative studies each have their unique strengths. However, the emphasis of each kind of study differs. Qualitative study focuses more on individual cases under specific organizational contexts, while quantitative study emphasizes hypothesis testing and generalization of findings. Currently, more and more researchers advocate combining quantitative and qualitative methods in a study (Kaplan and Duchon, 1988; Lee, 1991). Generally, the qualitative method can help to validate an instrument, to examine specific cases for deep understanding, and to clarify determinants. The quantitative method can be used to test the hypothesis.

**Table 4-1 Research methodology and process**

Qualitative Study	Goals	<ul style="list-style-type: none"> <li>● Gain insight on ASP adoption decision process</li> <li>● Clarify the constructs and questionnaires</li> <li>● Provide possible explanation for findings from the survey studies</li> </ul>
	Setting	<ul style="list-style-type: none"> <li>● Case interview on outsourcing decision of a course management system at a southeastern state university</li> </ul>
	Instrument	<ul style="list-style-type: none"> <li>● Interview questions validation: 2 academic scholars</li> </ul>
	Participants	<ul style="list-style-type: none"> <li>● Five interviews with key decision makers in this ASP adoption project (IT managers (2), Director of Center of Excellent Learning and Teaching, Director of Computing Service at Business School, Provost)</li> </ul>
Quantitative Study	Goals	<ul style="list-style-type: none"> <li>● Develop a valid and reliable measurement</li> <li>● Test the ASP adoption decision model</li> </ul>
	Pretest	<ul style="list-style-type: none"> <li>● Interview 9 practitioners and 5 scholars to test the two questionnaires for current ASP clients and non-current ASP clients</li> <li>● 9 practitioners include marketing manager and IT manages of ASP client (Campus Federal), directors of hosting center in famous software vendors (e.g., PeopleSoft, IBM), founders, CIOs of ASPs (e.g., Approsystems, Statability)</li> <li>● 5 scholars are professors from management, marketing and IS disciplines.</li> </ul>
	Pilot Test	<ul style="list-style-type: none"> <li>● Conduct a survey among full-time business professionals with 4-25 years experience: Executive MBA (EMBA) (6), Professional MBA (PMBA) (36) and IT professionals (22) from two technology associations</li> </ul>
	Formal Surveys	<ul style="list-style-type: none"> <li>● Conduct two surveys among decision makers of clients of a leading ASP in the lending industry (LASP) and randomly selected top computer executives (TCE)</li> <li>● Survey distribution and media <ul style="list-style-type: none"> <li>○ LASP's clients --- use e-mail to distribute survey and web is a primary method</li> <li>○ TCEs --- use mail to distribute survey, and mailing is a primary method</li> <li>○ Each participant has three options for survey fill-in and return: web, mail and fax</li> </ul> </li> <li>● Five-step survey administration <ul style="list-style-type: none"> <li>○ Pre-notice</li> <li>○ Survey distribution</li> <li>○ Two rounds of reminder (e-mail or postcard)</li> <li>○ Telephone reminder</li> <li>○ Thanks notes</li> </ul> </li> </ul>
	Data analysis and discussion	<ul style="list-style-type: none"> <li>● Missing value analysis and response bias analysis</li> <li>● Two-step PLS approach: measurement model and structural model</li> <li>● Regression model to test moderating relationship</li> </ul>

This study employs both the qualitative and quantitative techniques. It mainly adopts the quantitative technique to test the model and associated hypothesis. Before the quantitative study, case interviews are used to gain initial understanding about the decision process under the specific context and to clarify the constructs. The research methodology and detailed processes in both case interviews and survey studies are summarized in Table 4-1.

## **4.2 Case Interviews**

As the ASP adoption decision is a very complicated process, it is necessary to conduct case interviews to thoroughly understand this process and prepare for the quantitative study. The objective of the case interviews is to gain a deeper understanding of ASP adoption decision in an organization, to clarify the constructs important to the ASP adoption decision and questionnaires, and to provide a supportive explanation for the findings from the surveys.

### **4.2.1 Data Source**

In this study, the case focuses on a course management system outsourcing project in a southeastern state university. This university evaluated the ASP business model alternative to delivering a course management system for faculty and students off and on campus. There are several reasons to choose this project in this study.

Firstly, the goal is to investigate the ASP adoption decision. Thus, an organization that has made the ASP adoption decision is considered to be a good candidate. Moreover, as this large public university was just evaluating its online educational application decisions at the time of case interviews, members of the decision committee were able to provide accurate and detailed descriptions about the project and their considerations on the outsourcing of the online educational application. Thus, the data collected from these members were not colored or distorted by memory or time lag.

Secondly, in order to improve the data collection process, it is important that a researcher be familiar with settings and phenomena (Yin, 1994). The researcher was very familiar with the university under study and this course management application. These conditions provided an opportunity to conduct a successful case study.

Thirdly, it is critical to get access to data resources. The decision makers involved in this project were able to be identified and accessed for personal interviews. It was also easy and economical to schedule and conduct the face-to-face interviews with each decision maker, as the researcher is in that university.

Therefore, based on the objective of the study and available resources, this university's ASP adoption project was selected in this study for deep understanding of determinants.

#### **4.2.2 Data Collection**

The data were collected in two principal stages. In the first stage, before the formal data collection from the principal decision makers was attempted, some preliminary data, such as background information of the ASP company, were collected in order to have a comprehensive understanding of the case under study:

- 1) Collected secondary data, including the history and major products of the potential ASP vendor for this online course management application, from the vendor's website.
- 2) Tried the old educational systems used in the university at that time in order to understand the specificity of applications.
- 3) Discussed this case with my committee members who were familiar with the education application and this ASP project.

Through this preliminary data collection, a good understanding about the background information of this ASP project was gained, which was a help in preparing the formal interviews with the subjects. As interviews should only be used to collect the information which cannot be obtained elsewhere (Darke, et al., 1998), the data collected from other resources can significantly make interviews more effective. Information received or collected from multiple sources can enhance the validity and reliability of the data (Yin, 1994).

In the second stage, personal interviews were conducted with decision makers who were involved in this ASP project. Personal interviews were considered a good approach in this study because this is the best way to examine interviewee's opinions and interpretations of their actions, emotions, and other events (Walsham, 1995)

In this study, five individuals were interviewed to land an understanding of the decision making process of this adoption. Two interviewees are from the Office of Computing Service. They are directly in charge of application usage and hosting. The other two are from the university's management administration. The director of computer services in the College of Business, who initially started the Blackboard trial project, was also interviewed for more insights into this project. Each decision maker had a comprehensive understanding of the adoption decision. The interviews offered insight into the whole ASP adoption decision process and clarified the important determinants.

Interview instruments were prepared based on the theoretical literature presented in Chapter 2 and Chapter 3. Open-ended questions were used to solicit the interviewees' opinions about various factors impacting ASP adoption in this project. In order to validate the instrument, it was examined by two academic researchers and revised based on their comments. (Please see Appendix G for the interview instrument.)

During the personal interviews, the interview instrument was presented only in order to remind the researcher to cover all the factors. It was not given to the interviewees. Each interviewee was asked questions according to the instruments. The sequence of questions and the content of interviews varied slightly, according to the specific interviewees and conversations going on at that point. After that, interviewees were asked to check the definition of constructs and the pre-developed questionnaire and to give some comments for modification. With the permission of the interviewees, all the interviews were taped. Also, detailed handwritten notes were taken quickly during the interviews.

### **4.2.3 Data Results**

All these documents and materials gathered from the two-stage data collection process helped to clarify this complex ASP adoption decision process. The determinants developed in the ASP adoption decision model were illuminated through these interviews. The impacts of these constructs on the decision to outsource this course management system to an ASP were thoroughly studied.



These interviews were good preparation for survey studies, particularly in instrument development. In addition, these qualitative data could later help to explain the results from the survey studies. The detailed case interview process and findings from the qualitative data analysis are presented in Appendix J.

### **4.3 Research Methodology and Data Collection ---- Survey Study**

In addition to case interviews, a survey was adopted as a principal methodology in this study. In this section, the survey methodology is discussed. The sampling plan and unit of analysis are then described. The process for developing the detailed questionnaires is then presented, followed by a discussion of the data collection procedures employed that are associated with the two survey mechanisms: web survey and mail survey. Finally, the data analysis strategy is discussed.

#### **4.3.1 Research Methodology**

The objective of the quantitative part of this study is to understand the role of nine economic, strategic, and social factors associated with the ASP adoption decision from an integrative perspective. Eleven hypotheses of the individual effects of these factors and their interactions have been formulated based on the underlying theories presented earlier. Therefore, this study calls for a research method that effectively tests these hypotheses in an objective manner. Moreover, in this study, in order to test the relationships among these nine constructs, a large sample size is desirable in order to reach a certain level of statistical power, to increase the accuracy of the findings, and to satisfy external validity criteria. In addition, the questionnaires include several sensitive questions, as social factors, such as trust and personal relationship with an ASP, are examined in this study. As the research model developed here is relatively complex, it calls for a scientific analysis technique to effectively test the model.

Due to the nature of this study described above, a self-administered survey is considered to be an appropriate means to test the research model. As a principal quantitative method, the survey method enables researchers to collect the necessary data, to test the proposed relationships among the constructs and to generate findings relative to a population of interest. Several other benefits are also associated with the self-administered survey. Firstly, it is a

cost-effective approach to examining people's attitudes, behaviors, and intentions in a large population (Babbie, 1991, 1994). Secondly, it can use systematic questionnaires to collect information from participants in a reliable and unbiased way. Particularly, it provides anonymity for subjects when a study needs to investigate sensitive issues (Shadish, et al., 2002). Thirdly, sophisticated and powerful statistical techniques can be applied to analyze quantitative data effectively and find significant relationships among the constructs (Babbie, 1994). With these statistical techniques, the survey method has been widely utilized to test complex models (e.g., Susarla, et al., 2003; Lee and Kim, 1999).

Self-administered surveying therefore was chosen in this study. Specifically, two self-administered surveys were conducted among samples from the different sources.

### **4.3.2 Sampling**

#### **4.3.2.1 Sample**

In order to locate the respondents of a self-administered survey, it is important to understand the population of interest.

This study calls for a data source that demonstrates variations in dependent and independent variables, as variation is desired in conducting statistical analysis and achieving external validity. Thus, the study is not restricted to any particular industry or type of ASP in order to maximize the variation in independent variables. Moreover, in order to rule out possible effects of decision novelty, the survey subjects should have some experience in making IS sourcing decisions. Furthermore, as discussed in Chapter Three, two types of clients are involved in this study: ASP current clients and non-current ASP clients. Thus, in this study, the principal population of interest is top executives of organizations that are current ASP clients or non-current ASP clients.

In order to test the research model among the two groups of clients, two data sources were included in this study: clients of a leading ASP in the lending industry, and cross-industry top computer executives whose names were obtained from a commercially available list.

#### **4.3.2.1.1 ASPs' Clients**

ASPs' clients are chosen as a principal population in this study. There are several reasons for targeting this population. First, the objective of this research is to study the determinants of ASP adoption. Since the total number of ASPs is still relatively few in the current market, in a random sample of all companies, the percentage of current ASP clients could be very small. A 2002 survey conducted in Irish companies indicated that 50% of executives were not aware of the ASP business model (CGEY, 2002). Hence, the best way to reach ASPs' clients is through an ASP. Second, many companies cannot give valuable responses, as they have never considered ASPs or been aware of the ASP business model at all. The data collected from such companies would decrease the internal validity of the results, as these responses cannot help to detect true determinants. Conversely, ASP clients are aware of the ASP business model and have carefully considered its adoption. These clients have clear ideas about their decision-making process. Thus, the data collected from them would increase the internal validity of the results. Third, since ASPs' clients have already adopted ASPs, their opinions may present decision factors of those companies who are more likely to adopt ASPs.

Hence, ASPs' clients represent one particular population of interest. In this study, a successful ASP was identified first and its clients were accessed through these ASPs. This approach is shown to be effective by Lee and Kim (1998) to access a sample of clients.

Originally, more than twenty ASPs were contacted for sponsorship. However, only three of them expressed interest in this study. Currently, only one ASP has participated in this study. Thus, clients of this large ASP (named as LASP) were considered as the first sample source. In this study, these clients formed the specific population under investigation.

LASP is a leading provider of lending technologies tailored to clients in the financial industry. Founded in 1978, LASP serves over 300 of North America's leading financial institutions, including vehicle financing, direct financing, credit card, home improvement and home equity lenders. Its clients include a wide range of financial institutions, both large and small.

Originally, LASP offered only on-site licenses to clients. Since 1999, it has started to transition its business model towards online lending applications. A central database and financial application services are hosted by the company. Clients need only to log onto LASP's website in order to process their transactions. After its initial adjustment, LASP has become a successful ASP.

LASP is interested in this study, as it wants to systematically understand the determinants impacting current clients' ASP adoption decision. The findings can help them effectively attract similar clients. From the research's perspective, in this study, there are several reasons to choose clients of LASP as the first population:

- 1) LASP serves the financial industry. This industry is generally receptive to using new technologies and business models. Outsourcing has been used in this industry for a long time as an option for resource management (Ang and Straub, 1998). Thus, these financial companies, such as banks, credit unions, and lending centers, should provide a knowledgeable perspective regarding the ASP adoption decision.
- 2) LASP is relatively aggressive at providing the most comprehensive set of decision tools for clients in the lending industry. With over 20 years of serving experiences, LASP has a substantial and active client base spread across the United States. As a large client base can manifest different levels of IT deficiency, it can increase the external validity of potential findings. With a relatively large market share, we expect its wide-ranging clients to provide variations in the independent variables.

Moreover, not every employee in an organization can give a valid response to the survey. Only actual decision makers can offer a comprehensive view about this complicated decision process. Usually, high-level managers are key decision makers involved in this IT management decision. Also, even though in some organizations a committee is formed to make the final decision, high-level managers are assumed to be able to reflect the overall view of the committee. Thus, high-level managers (e.g. CIO, CEO) in client organizations of LASP constituted the first sample in this study.

#### **4.3.2.1.2 Top Computing Executives**

Besides current clients of the ASP, top computing executives (TCE) from all over the United States form the second population of interests.

Due to several reasons, this sample was considered as the second data source.

- 1) The first sample frame is formed by clients of LASP, where the focus is on opinions of current clients. However, it is also important to gain the opinion of another type of client - non-current ASP clients - in order to learn about the ASP adoption decision from a different perspective. Hence, companies were deliberately selected randomly across the nation in order to gain a broader perspective.
- 2) With no restriction on industry, all companies across the U.S. represent the population from which the sample was drawn.
- 3) As discussed above, these TCEs were assumed to be the ASP adoption key decision makers for IS sourcing management in their respective organizations. Thus, TCEs can represent the population of interest in this study.
- 4) These TCEs were taken from a list typically utilized by IS researchers and published by an applied research company (see the publisher website: <http://www.acrhq.com/tce/tcemain.htm>). This list is updated twice a year to maintain the newest contact information of TCEs. More than 90,000 companies located in 50 states are included on this list. Moreover, this list has been used several times by publications in MIS Quarterly. For instance, see Enns, Huff and Higgins (2003). These studies further confirm the feasibility and accuracy of this list.

Based on these reasons, randomly selected TCEs from this publicly published list formed the sample of the second data source. As a good supplement to the first sample frame, opinions of both non-current ASP clients and ASP clients can be obtained.

The random selection algorithm is described as follows. This public list has 1045 pages. First, the first company on each page was picked out, so 1045 companies formed the initial sample pool. Second, considering the survey cost, the total sample size was set as 1000, so 45 companies needed to be excluded from this initial sample pool. In order to delete companies equally from these 1045 companies, after every 22 companies, one company was excluded. For instance, the excluded companies were the cases of 23rd, 46th, 58th, etc. Then 1000 companies were randomly selected. Finally, TCEs from these 1000 companies formed the second sample for this study.

#### **4.3.2.2 Unit of Analysis and Subjects**

In this study, determinants of ASP adoption and their interactions are examined at the organizational level. The unit of analysis is organizations which are considering or have made the ASP adoption decision.

In both samples, the actual participants in the survey were decision makers of organizations, as they are knowledgeable of the entire decision process as well as company IT policies. For the first sample, LASP provided the contact information (e.g., e-mail address and telephone number) of the vice president of technology, IT director or vice president of lending. These individuals were assumed to be the most knowledgeable of previous ASP adoption decision.

For the second sample, 1000 TCEs were randomly selected from a published list without any restriction on location or industry. Hence, the subjects targeted in the survey were TCEs, who were assumed to be the primary decision makers for ASP adoption decisions in each organization. Contact information of TCEs, including mailing address and telephone number, were used to contact all the subjects and encourage them to participate in the study.

#### **4.3.3 Instrument Validation**

Based on the instrument development and validation procedure recommended by Straub (1989), three steps were adopted in this study to develop a valid instrument: develop a questionnaire based on past valid instruments, pretest it among practitioners, and pilot test it.

#### **4.3.3.1 Questionnaire Development**

Based on a literature review, most of the measurements were borrowed from previously validated instruments in outsourcing studies, and further modified under the context of the ASP business model. Table 3-1 in Chapter 3 shows the key literature upon which the constructs were formulated.

Besides these, a few questions were developed based on the operational definitions of constructs. Chapter 3 has addressed the operational definitions, including social and personal relationship, IT deficiency removal and application importance. For the construct of social and personal relationship, questions were asked about personal relationship at the managerial level between client companies and ASPs. For the construct of IT deficiency removal, questions were asked about the effect of an ASP on filling in the gap between the clients' strategies and their internal IS capabilities. For the construct of application importance, questions were asked about extents of application importance to a company's operation and strategy. For each construct, about 10 measurement items were developed. This method is recommended by Netemeyer, et al., (2003) to prepare for item deletion in the pretest and the pilot test.

In this study, two questionnaires were developed, one for non-current ASP clients and one for current ASP clients. The questions in the two versions were similar, but some wording was adjusted to suit their different outsourcing situations. For example, for current ASP adopters, questions were asked about their current online applications and ASPs. For non-current ASP adopters, questions were asked about their general perceptions of ASPs and online applications which could be outsourced.

As most questions were developed based on the previous literature, the instruments have demonstrated reliability and construct validity in previous studies. However, as some questions have been modified under the context of ASP and new items were formulated to measure new constructs, a pretest was required to achieve content validity and face validity of the instruments.

#### **4.3.3.2 Pretest**

"Content validity of a measurement instrument for a theoretical construct reflects the degree to which the measurement instrument spans the domain of the construct's theoretical

definition. It is the extent to which a measurement instrument captures the different facets of a construct.” (Rungtusanatham, 1998, p.11). In order to demonstrate content validity, instruments should represent the full domain of constructs. Domain experts who are familiar with research phenomena are good candidates to review initial questionnaires (Straub, 1989). Hence, in this study, the initial questionnaires were reviewed by academic scholars and by practitioners from industry.

The academic scholars selected were either good at instrument development and/or knowledgeable in the ASP business model. They were professors in IS, management or marketing disciplines. Questionnaires and construct definitions were sent to these scholars for review. Based on their knowledge in scaling development, their comments on revised questionnaires enhanced the validity of the instruments.

The practitioners were chosen from five organizations. Among them, one company is a client of an ASP. This company is a credit union who has adopted the ASP business model for its online banking services. The participants in the study were involved in the ASP adoption decision, including the marketing manager and the IT managers. Two other organizations were large software/service vendors who have successful hosting businesses, IBM and PeopleSoft. The participants were directors of hosting centers. Another two organizations were ASPs. One was providing lending services to financial institutions, and the other was providing reporting services to hotels. The participants were founders or CIOs of each ASP. These practitioners were all familiar with the ASP business model and were aware of the various considerations in IS sourcing. Thus, these domain experts were qualified to judge the domain coverage of the instruments.

In this study, the instruments were pretested among practitioners by means of group interviews. Group interviewing is often used for research exploration in the beginning stage in order to test the face validity and content validity of instruments (Fontana and Frey, 1998). Moreover, interviewing is a good way to get in touch with subjects and gain in-depth understanding by direct interaction with them (Babbie, 1994).

Three group interviews were conducted among nine participants from the above mentioned five organizations. Each group had two or three participants. During these group



interviews, a brief introduction of study objectives, a construct definition, and an initial questionnaire were presented to all the participants. These participants were given time to examine the questionnaire individually. Then, they discussed any unclear items or inadequately measured constructs in the questionnaire. Through extensive discussion of existing questionnaires and reference to construct definition, they offered suggestions to improve the questionnaire. For example, the wording of unclear items was adjusted, some questions were added to strengthen construct measurement and classify background information of clients, and vague questions were deleted altogether from the questionnaire.

During the pretest, as these participants who were familiar with the content universe were required to evaluate the instrument again and again until a form of consensus was reached, the questions were assumed to cover all possible facets of a construct, particularly the definitions of the construct. As face validity and content validity means that the questionnaires can represent the domain meanings of constructs, this instrument has achieved face validity and content validity. Meanwhile, these participants were required to examine definitions and questions at the same time. In this way, questions were certain to actually measure the construct which they were supposed to measure. Thus, construct validity of the instrument was achieved to some extent.

Based on all the feedback from both practitioners and scholars, a new version of the questionnaires was developed.

#### **4.3.3.3 Pilot Test**

“The pilot survey is the dress rehearsal, and like the theatrical dress rehearsal, it will be preceded by a series of preliminary tests and trials (i.e., the pretest)” (Moser, 1958). A pilot test is strongly recommended to quantitatively assess reliability and construct validity of instruments (Straub, 1989).

After the revision of the questionnaires, a pilot survey was conducted among practitioners, professional MBAs and Executive MBAs with work experience ranging from 4 to 25 years. Practitioners who participated in this pilot study represent two organizations: the Louisiana Technology Center and the Baton Rouge Technology Council. These members either ran their own businesses or were senior managers in charge of IT in their organizations. Since

the Louisiana Technology Center and Baton Rouge Technology Council were active in promoting new technology and new IT business models, these members were knowledgeable about the ASP business model. Thus, it was assumed these members were suitable for this pilot study. Roughly 24 practitioners participated in the pilot study.

EMBA and professional MBA (PMBA) were business professionals having 4-25 years working experiences who were enrolled in part-time MBA programs. Most of them were senior managers, IT professionals, or business managers in companies. Their responsibilities ranged from mid-level management of operational functions to mid-level management of support functions, e.g., plant manager, engineering manager, CEO, CIO, web manager, and project manager. They were knowledgeable about the ASP business model. Thus, these business professionals approximately represented the population of interest in this study.

About 22 practitioners and 42 MBAs participated in the pilot study. Practitioners' data were collected during their regular meeting. These practitioners were asked to fill in the survey after the meeting. MBA data were collected in the class. All the participants in this study were given two questionnaires – one for current ASP clients and one for non-current ASP clients – at the same time. They filled in one questionnaire according to the outsourcing situation of their organizations. For example, if the company did not adopt any ASP, the participant would fill in the questionnaire for non-current ASP clients.

After the deletion of incomplete responses which had more than 10 percent of the data missing (Hair, et al., 1998), 60 complete responses were used for data analysis. Among these responses, there were 40 non-current ASP clients and 20 current ASP clients. The demographic information of participants is listed in Table 4-2.

Statistical analysis was conducted on the data of the two groups. For the group of non-current ASP clients, both exploratory and confirmatory factor analyses were run to assess reliability and discriminant validity. Reliability examines whether multiple items measure the same construct. Discriminant validity examines whether the items which are supposed to measure one construct are distinct from those measuring another construct.

**Table 4-2 Sample demographic**

	Total Sample		ASP-clients		Non-ASP-clients	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
<b>CEO/CIO</b>	16	26.67	7	35	9	22.5
<b>IS Manager</b>	23	38.33	6	30	17	42.5
<b>Function Manager</b>	13	21.67	5	25	8	20
<b>Others</b>	8	13.33	2	10	6	15
<b>Total</b>	60	100.00	20	100	40	100

As indicated in Table 4-3, for most constructs, most items measuring the same construct loaded together with a relatively high score. Each construct also presented a good Cronbach Alpha, which indicated a good reliability of this measurement. Factor loadings of items and Cronbach Alpha of each construct are displayed in Table 4-3.

Moreover, the correlation among items measuring different constructs was relatively low, and the correlation among items measuring the same constructs was higher. Most of these measurements showed good discriminant validity among different constructs.

However, the results also presented some problems. The items measuring trust double loaded with the items measuring an ASP's capability, which means these items correlated highly with both constructs of trust and ASP's capability. The reason for this problem could be that as non-current ASP clients had no actual experience with ASPs, they confused the expectation of an ASP's capability with the evaluation of current ASPs' capability. Thus, items used to measure ASP's capability were revised to instruct participants to generally evaluate current ASPs' capability. Moreover, items used to measure cost benefits were separated into two parts: the first five items loaded together and the last five loaded together. The most likely reason was that these items were worded in two different styles, and participants tended to answer the questions of the same style in a similar way. Thus, these items were revised to reduce the differentiation of presentation effects. Some bad items with very low factor loadings (less than 0.4) were deleted from the questionnaires.

**Table 4-3 Factor loading and Cronbach alpha**

Construct	Items	Factor Loading	Cronbach Alpha
Uncertainty	uncertainty1	0.764	0.864
	uncertainty2	0.625	
	uncertainty3	0.769	
	uncertainty4	0.693	
	uncertainty5	0.718	
	uncertainty6	0.731	
	uncertainty7	0.715	
	uncertainty8	0.744	
	uncertainty9	0.546	
Asset Specificity	asset specificity 1	0.606	0.8779
	asset specificity 2	0.609	
	asset specificity 3	0.664	
	asset specificity 4	0.799	
	asset specificity 5	0.815	
	asset specificity 6	0.643	
	asset specificity 7	0.750	
	asset specificity 8	0.789	
	asset specificity 9	0.698	
Cost Benefits	cost benefits 1	0.590	0.8817
	cost benefits 2	0.557	
	cost benefits 3	0.778	
	cost benefits 4	0.719	
	cost benefits 5	0.726	
Deficiency Removal	deficiency removal 1	0.869	0.93
	deficiency removal 2	0.895	
	deficiency removal 3	0.897	
	deficiency removal 4	0.916	
	deficiency removal 5	0.758	
	deficiency removal 6	0.735	
	deficiency removal 7	0.711	
Application Importance	application importance 1	0.807	0.9297
	application importance 2	0.820	
	application importance 3	0.788	
	application importance 4	0.870	
	application importance 5	0.878	
	application importance 6	0.583	
	application importance 7	0.545	

(Table 4-3 cont.)

Construct	Items	Factor Loading	Cronbach Alpha
Capability	capability1	0.556	0.9128
	capability2	0.680	
	capability3	0.722	
	capability4	0.646	
	capability5	0.520	
	capability6	0.719	
	capability7	0.716	
	capability8	0.769	
	capability9	0.830	
Trust	Double loaded on capability		
Relationship	relationship1	0.625	0.7101
	relationship2	0.760	
	relationship3	0.761	
	relationship4	0.460	
ASP Adoption	ASP adoption 1	0.570	0.631
	ASP adoption 2	0.651	

For the group of current ASP clients, the sample size was only 20, which is not large enough to run a factor analysis. However, confirmatory factor analysis was still conducted to evaluate construct validity among current ASP clients, but the result was interpreted cautiously. The main problems included:

- 1) Some items supposed to measure cost benefits and some items supposed to measure application importance had high loadings on the same factor.
- 2) All the items supposed to measure cost benefits did not have high loadings on the same factors, but they loaded on the two different factors.
- 3) Items supposed to measure ASP's capability did not consistently show high loadings on the same factor.

This measurement problem about construct of cost benefits was similar to the problem that occurred with the group of current ASP clients. All the items were loaded in the two different factors. The reason was still associated with question style. As to the other problems, no convincing explanations could be provided. However, too small a sample size in this group

significantly reduced the power of statistical analysis. Hence, these results from factor analysis could serve only as references for modification, but were not conclusive. In order to increase validity, items used to measure cost benefits, application importance and ASP's capability were further modified in wording, sequence, and layout. The instructions for these items were also clarified.

As the sample size of each group was not large enough, relationships among the constructs were not tested. However, according to Straub's instrument validation procedure, the objective of a pilot test is to test the reliability and construct validity of an instrument (Straub, 1989). Thus, testing of construct relationship was not a major concern at this stage.

Based on these analyzed results, measurement items in the two questionnaires were extensively modified. Survey instructions were also clarified in order to reduce the ambiguity. Items which could not effectively measure the construct were deleted from the questionnaire. However, the deletion was processed very carefully and most items were kept, as a small sample size of the pilot data could not give sufficient reason for deletion, particularly for the questionnaire of non-current ASP clients. Thus, for each construct, about 6 to 7 items were used to measure it. This ratio is suggested by Netemeyer, et al., (2003) for instrument validation.

A modified version of questionnaires was further reviewed by two practitioners and two professors for comments. The two practitioners were from an ASP hosting center in one of the top 5 e-business service providers. One professors were from IS and the other from marketing. Both were experts in instrument development. After further modification based on their feedback, the questionnaires were ready for the formal survey. The final validated survey questionnaires are presented as Appendix A-1, A-2. The wording of each question in the final instruments and the code for each item are presented in Table 4-3.

To current ASP clients, most questions assessed the decision to adopt the most typical applications. It is assumed that the determinants for these applications can represent the decision to adopt other applications in a company. In this way, the reasons for the overall status of ASP adoption can be assessed. To non-current ASP clients, questions assessed their general ideas about the overall ASP adoption decision, without referring to any specific application.

In the two questionnaires, ADPTOTAL was used as an item to measure the overall situation of outsourcing functions in a company. It is the sum of the outsourcing status of thirteen different applications, such as finance, manufacturing, sales, etc. There are two reasons to use this item. First, the purpose of this study is to measure the overall ASP adoption in a company, not the specific application. Second, as application areas of a company are huge, the company is more likely to outsource one portion. Thus, it is reasonable to sum up all the applications and use it as an item to assess the overall ASP adoption situation or intentions.

In the measurement of Degree of ASP adoption, in addition to ADPTOTAL, three other items, ADPWAY, ADPPERC, and ADPBUDG were all used to measure the overall ASP adoption situation in a company (see Table 4-4 for specific questions).

In the measurement for “ASP adoption intention”, in addition to ADPTOTAL, which is the sum of outsourcing intents of thirteen different applications, six other items - ADPGEN, ADPMOST, ADPTIME, ADPWAY, ADPPERC and ADPBUDG - were also used to measure overall ASP adoption intention in a company (see Table 4-4 for specific questions).

#### **4.3.4 Survey Data Collection Procedure**

After development and validation of the questionnaires, formal surveys were conducted among target samples. Web survey and mailing survey were used as the principal methods, respectively, according to the available contact information in the two samples. Based on the data collection procedure recommended by Dillman (2000), multiple steps, including pre-notice, survey distribution, first/second reminder, telephone reminder, and thank-you notes, were administered among each sample. In this section, two major survey media – web and mail – are introduced. Then the five steps of survey data collection procedures are discussed in detail.

##### **4.3.4.1 Survey Media**

Since LASP could provide client e-mail addresses, the web survey was adopted as the principal method to reach its clients. In contrast, the mail survey was employed as the major method to reach TCEs, as only their mailing addresses were available.

**Table 4-4 Items in the questionnaires**

<b>Construct</b>	<b>Item</b>	<b>Wording</b>	<b>Source</b>
<b>Uncertainty</b>	UNCA1	the overall economy/market	Miller and Friesen (1982)
	UNCA2	government policies or regulations impacting your organization management	Ang and Cumming (1997)
	UNCA3	business practices needed for you to remain competitive in our industry	Zaheer and Venkatraman (1995)
	UNCA4	customer requirements/needs in our industry	Benamati and Rajkumar (2003)
	UNCA5	market share competition in our industry	Miller and Friesen (1982)
	UNCA6	technology for operations and production in our industry	Miller and Friesen (1982); Ang and Cumming (1997)
	UNCA7	supply of labor / materials in our industry	Miller and Friesen (1982)
	UNCA8	introduction of new products in our industry	Zaheer and Venkatraman (1995)
<b>Asset Specificity</b>	ASS1	require ASP make a substantial investment in equipment tailored to our needs	Zaheer and Venkatraman (1995); Grover, et al.,(1998)
	ASS2	require ASP make great efforts to customize software for our applications	Zaheer and Venkatraman (1995); Grover, et al.,(1998)
	ASS3	require ASP specialized technical knowledge	Zaheer and Venkatraman (1995), Grover, et al.,(1998)
	ASS4	require ASP possess specialized business knowledge	Zaheer and Venkatraman (1995), Grover, et al.,(1998)
	ASS5	compared to our competitors, our company used more hardware platforms and multiple systems configurations	Ang and Straub (1998)
	ASS6	compared to our competitors, our company's software portfolio was more sophisticated/complex .	Ang and Straub (1998)
	ASS7	compared to our competitors, our data processing operations were more complex	Ang and Straub (1998)
	ASS8	compared to our competitors, we needed more specialized IS functions to operate our business	Ang and Straub (1998)
<b>Cost Benefits</b>	COS1	reduce our hardware costs	Ang and Straub (1998); Grover, et al.,(1996)
	COS2	reduce our software costs	Ang and Straub (1998); Grover, et al.,(1996)
	COS3	reduce our costs of hiring new information systems personnel	Ang and Straub (1998); Grover, et al.,(1996)
	COS4	reduce our costs of training new and/or existing information systems personnel	Ang and Straub (1998); Grover, et al.,(1996)
	COS5	reduce the costs of modifying existing applications	Ang and Straub (1998); Grover, et al.,(1996)
	COS6	it is cheaper to monitor our ASP than to manage our own data processing facilities	Ang and Straub (1998); Grover, et al.,(1996)
	COS7	it is cheaper to extend an application with our ASP than with traditional software vendors	Ang and Straub (1998); Grover, et al.,(1996)
	COS8	it will require a minimal amount of time and effort to negotiate a contact (e.g. conditions, prices, etc.) with our ASP	Ang and Straub (1998); Grover, et al.,(1996)
	COS9	it will cost a little to switch to another ASP	Ang and Straub (1998); Grover, et al.,(1996)



(Table 4-4 cont.)

<b>Construct</b>	<b>Item</b>	<b>Wording</b>	<b>Source</b>
<b>IT Deficiency Removal</b>	DEF1	compensate our lack of IT infrastructure establishment, including necessary software and hardware	Grover, et al. (1994)
	DEF2	compensate our shortage of qualified IT professionals	Grover, et al. (1994)
	DEF3	compensate our insufficient levels of IT professionals	
	DEF4	compensate our insufficient IT investment	Self developed
	DEF5	compensate our lack of ability to process information in a timely manner	Grover, et al. (1994)
	DEF6	compensate our shortage of quick adaptation to industrial IT change	Grover, et al. (1994)
	DEF7	compensate our lack of ability to execute our business strategy (e.g., online transactions, system integration)	Self-developed
<b>Application Importance</b>	IMP1	provide critical functions for our business.	Self developed
	IMP2	being vital to our overall business operations	
	IMP3	directly impact our daily business operations.	
	IMP4	closely integrate with our regular business operations	
	IMP5	provide core business functions for our business	
	IMP6	facilitate data integration throughout our whole company.	
<b>ASP's Capability</b>	CAP1	completely understand our business processes	Lee and Kim (1999)
	CAP2	perfectly understand our business objectives	Lee and Kim (1999)
	CAP3	clearly comprehend their roles and responsibilities in supplying our objectives	Lee and Kim (1999)
	CAP4	provide exact functions that we need for business operations	Ganesan (1994)
	CAP5	provide clear criteria for its initial application recommendations	Swinarski, et al. (2001); Ganesan (1994)
	CAP6	assure security for data exchange and storage	Swinarski, et al. (2001); Ganesan (1994)
	CAP7	provide 24/7 maintenance for our applications	Swinarski, et al. (2001); Ganesan (1994)
	CAP8	update rented applications efficiently	Swinarski, et al. (2001); Ganesan (1994)
	CAP9	ensure network connection for service delivery	Swinarski, et al. (2001); Ganesan (1994)

(Table 4-4 cont.)

Construct	Item	Wording	Source
<b>Social and Personal Relationship</b>	REL1	our ASP managers must be known to us	Kern, et al. (2001)
	REL2	our ASP must be well known in our industry	Self-developed
	REL3	we must have had social contacts with our ASP	Kern, et al.(2001); Henderson (1990)
	REL4	we must have had personal contact with the founder/CEO of our ASP	Kern, et al.(2001); Henderson (1990)
	REL5	we must have had a close personal relationship with the managers of our ASP .	Kern, et al.(2001); Henderson (1990)
<b>Trust</b>	TRU1	ASP can make beneficial decisions for us under any circumstances	Anderson and Narus (1990); Morgan and Hunt (1994); Lee and Kim (1999)
	TRU2	ASP can provide assistance to us without exception	Grover, et al. (1996); Lee and Kim (1999)
	TRU3	ASP can be sincere at all times.	Grover, et al. (1996); Lee and Kim (1999)
	TRU4	ASP can show a sincere interest in solving its customers' problem	Anderson and Narus (1990); Morgan and Hunt (1994)
	TRU5	ASP can provide required functions under all conditions	Anderson and Narus (1990); Morgan and Hunt (1994)
	TRU6	ASP can provide highly reliable services	Anderson and Narus (1990); Morgan and Hunt (1994); Lee and Kim (1999)
<b>ASP Adoption</b>	ADPTOTAL	sum of adopt status regarding 13 different applications	Ang and Straub (1998)
	ADPWAY	the primary way in which your firm's information systems are managed and operated	Ang and Straub (1998)
	ADPPERC	among applications that could be outsourced, what percentage of them are current ASP services	Grover, et al.(1994)
	ADPBUDG	among IT budget for applications that could be outsourced, what percent is used for ASP services	Grover, et al. (1994)
<b>ASP Adoption Intention</b>	ADPGEN	how likely to use ASP for our business applications	Davis (1989)
	ADPMOST	how likely to use ASP for most applications	Davis (1989)
	ADPTIME	how likely to use ASP in one or two year .	Self-developed
	ADPTOTAL	sum of the extent of intention to adopt 13 different applications	Ang and Straub (1998)
	ADPWAY	the primary way in which your firm's information systems are managed and operated	Ang and Straub (1998)
	ADPPERC	among applications that could be outsourced, what percentage of them is likely to be ASP services?	Grover, et al.(1994)
	ADPBUDG	among IT budget for applications that could be outsourced, what percent is likely to be used for ASP services	Grover, et al. (1994)

However, every participant in this study was given the choice of three options (web, mail, and fax) to fill in the questionnaire and return it. To the first group of participants, besides the web survey, a printable paper version of the questionnaires was available for downloading on the website. Similarly, to the second group of participants, besides the mail survey, the URL of the survey website was also provided in the mail sent to them. Moreover, on the website and mail survey, fax number and mailing address were listed to offer other media. The survey also could be faxed to subjects upon their request.

Hence, though the web survey and the mail survey were adopted as the principal methods for the two samples, respectively, actually each participant was offered three options: fill in survey online, fill in paper survey and mail it back, and fill in paper survey and fax it back. In the following sections, the web survey method and mail survey method will be justified.

#### **4.3.4.1.1 Web Survey**

The web survey method has many advantages for both researchers and participants over other general methods (Medlin, et al., 1999). The most important and direct benefits of the web survey method are saving time on coding and data reentry for researchers, and increasing the accuracy of data entry (Dillman, 2000). For researchers, since all surveys and answers are designed in a machine-readable format, an electronic data file containing all the records will be ready for analysis immediately following data collection. Without any manual manipulation, data entry errors can be reduced to a minimum. Moreover, participants enter answers on the website and their answers are transferred into a central database immediately. Participants do not need to print anything out or send the survey questions back. Another benefit is that researchers can significantly save time and money in survey preparation as well as in survey response delivery. In a large sample mail survey, researchers spend significant time preparing hundreds and thousands of mail questionnaires with a personal identification on each. Also, the postal expense for a large number of questionnaires is high. The web survey method can nearly eliminate this cost and enable a quick response. Finally, computer systems can help researchers to check for completion of responses as well as remind participants to answer the critical questions that they might otherwise miss.

In order to test the effectiveness of the web survey method, Bowker (1999) analyzed about 1,000 web surveys conducted in the U.S. for various purposes. He found that web surveys have good outcomes and are shown to be a mature technique with advanced features to support research. Moreover, mail surveys and web surveys do not show any significant differences in the quality of responses (Dillman, 2000). Compared with the mail survey, web is still a relatively new medium for survey. Therefore, it is expected to attract more participants and thus gain a higher response rate.

Based on these advantages, the web survey method was adopted in this study for both samples. Websurveyer 3.1 is the software used in this study for survey publication and data collection.

#### **4.3.4.1.2 Mail Survey**

The mail survey method is traditionally used in academic survey studies. Mail survey has a long history in research. It is considered to be an effective method of getting feedback from survey subjects (Dillman, 2000), and it has been used widely in both research and practice. Without any special restriction on devices and skills (e.g., computer accessibility required by web-based survey), mail survey provides participants flexibility in filling in the survey (Dillman, 2000).

Besides mail survey and web survey, fax, as another paper-based medium, is a good alternative. It can speed up the survey distribution and return. Participants can fill in the paper questionnaires and fax them back.

As mentioned before, in this study, three options of survey (web, mail, and fax) were offered to sample subjects. These multiple options gave participants more flexibility in filling in a questionnaire. This multiple-media approach has been previously shown to increase the response rate effectively (Babbie, 1994).

#### **4.3.4.2 Survey Distribution**

Dillman (2000) provides an in-depth discussion based on numerous studies on implementation for both mail survey and Internet survey under different survey purposes and

situations. Total Design Method (TDM), which includes specific procedures for survey administration, has demonstrated the ability to achieve high response rates (Dillman, 2000). TDM suggested five rounds of correspondence, including pre-notice, survey distribution, first reminder, second reminder and thank-you notes. Multiple rounds of contacts with participants have been proven effective to increase response rate by many mail surveys and web surveys (Dillman, 2000; Bowker, 1999). In this study, TDM was employed to guide administration of both the web survey and the mail survey.

The website was set up and maintained at Louisiana State University. The WebPages were carefully designed for consistency of survey display on different types of computers (Dillman, 2000), so that subjects would not be confused by screen layout. Also, before administering this web survey and sending out the mail survey, the exact completion time of the survey was estimated by a practitioner and a Ph.D. student. Subjects in both samples were informed of this estimated time in the e-mail notice and mail notice.

#### **4.3.4.2.1 Pre-notice**

- **Clients of LASP**

Pre-notice e-mails were sent out to all subjects. Research objectives and the importance of participation were briefly introduced in these personalized e-mails to inform subjects of an upcoming web survey (See Appendix B for an e-mail example). Several emails were bounced back because of incorrect e-mail addresses. LASP offered help to correct some of these addresses. Then, pre-notice e-mails were sent again to these subjects.

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Pre-notice postcards (one quarter of letter paper, ivory color) were mailed to all subjects. The logo of Louisiana State University was printed on the front cover side of the postcard. On the back side of the postcard, research objectives and the importance of participation were briefly introduced. Subjects were also informed of the upcoming mail survey. In order to save costs, these postcards were sent out by bulk rate. Bulk rate is reserved only for a large distribution quantity (e.g., 500 pieces) by non-profit organizations.

The stamps of “non-profit mailing” were printed on the right corner of the front cover side. Please see Appendix C for an example of pre-notice.

#### **4.3.4.2.2 Survey Distribution**

- **Clients of LASP**

Five days after the pre-notification e-mail, the first-round survey e-mails containing a survey website URL were sent out to all the subjects. The subjects could click onto the link and respond to the survey. When they finished the survey, they could click the “submit” button and send their answers back to the server immediately. There was no means of preventing someone’s filling in the questionnaires twice. However, considering the length of the questionnaire (more than 95 questions), the participants were not likely to fill in the questionnaires more than once.

In the first page of the web survey on the website, subjects could also download printable survey questionnaires in word or pdf files. Contact information of the researchers, including fax number, mailing address, and e-mail address, were provided both on the website and the cover page of the downloadable questionnaires.

Each subject was assigned a special ID, which was able to be embedded in the web URL in survey distribution. These special IDs were used to track responses when the responses were filled in on the web. In this way, in the first/second round of reminders, only the non-respondents would be contacted. However, if the subjects filled in the paper version of questionnaires, the responses could not be tracked.

Moreover, according to Dillman’s guide (2000), copies of the study results were offered to all the subjects as a token gift.

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One week after the mailing of the postcards, the survey package was mailed out in a formal 10# envelope with LSU’s logo and the address of the ISDS department. Each package included a personalized cover letter printed on formal letter paper with the LSU

letterhead, a pre-paid return business envelope, and two folded questionnaires printed on 11x17 Xerox paper, respectively.

The research objective, importance of participation, three options of survey media, and contact information were described in the cover letter (See Appendix D for a sample). Copies of the results were offered to all the subjects as a token gift. Each subject was instructed to answer only one of the two questionnaires according to the ASP usage situation of his/her company.

As one of the three options, this group of subjects could fill in the web survey by visiting this website, <http://projects.bus.lsu.edu/yao>. Each return business envelope was numbered, in order to track the responses. Then in the first/second reminder, only non-respondents would be contacted. However, if these subjects filled in the survey online, they could not be tracked.

The specially designed LSU envelopes that were used in the survey, to some extent, could attract subjects to open the envelope and look at the materials inside. In order to reduce costs, survey packages were sent out by bulk mail rate.

#### **4.3.4.2.3 First/Second Round Reminder**

- **Clients of LASP**

Because of nearly zero e-mail delivery time, the interval time between sending out the survey and receiving the responses should be about one or two weeks (Dillman, 2000). Two weeks after the survey e-mail, a personalized first reminder e-mail with similar content was sent out to non-respondents in order to remind them of this survey study (See Appendix E). In the e-mail, the general participation situation up to that time was briefly summarized to emphasize the value of this study and encourage the participation. Furthermore, two weeks after the first reminder, a personalized second reminder e-mail with similar content was sent to non-respondents again.

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Three weeks after the first survey, the first reminder postcards (one quarter of letter paper, ivory color) were sent out to non-respondents (See Appendix F for postcard sample).

In the postcards, the three options to participate in the survey were listed again, and a brief summary of collected responses up to that time was presented to encourage participation.

#### **4.3.4.2.4 Telephone Reminder**

It is shown that using a different medium other than the one used for survey distribution as a reminder is more effective in encouraging participation (Dillman, 2000). Thus, in order to increase the response rate, two weeks after the second e-mail reminder and first round post card reminder, non-respondents were personally called and encouraged to complete and submit the survey. Two MBA students with telephone sales experience were hired to make calls to the TCEs, and the researcher of this dissertation made the calls to LASP's clients.

If subjects were not reached on the first call, voice messages were left on their telephone and multiple calls were made later in order to reach subjects and personally encourage them to participate in the survey.

In the case where subjects could not recall being mailed or e-mailed a survey questionnaire, the subjects were offered the option of a replacement survey e-mail or a faxed paper-version of survey questionnaires with a cover letter in order to encourage their participation in the survey.

#### **4.3.4.2.5 Thank-you Notes**

Two weeks after the personal calls, thank-you emails were sent out to all responding subjects in the survey. As all TCEs who participated in the study provided their e-mail addresses, thank-you notes were distributed via e-mail.

Regarding the non-responding participants, the nature of their non-responses is examined in order to evaluate non-response bias and external validity (see Chapter 5).

### **4.3.5 Data Analysis Strategy**

In this study, considering the complexity of the research model and the relatively small sample size of the returned data, partial least squares (PLS) was used as the analysis tool to test the research model.



#### 4.3.5.1 Partial Least Square

PLS is a structural path estimation approach (Chin, 1998). Similar to other structural equation modeling (SEM) estimations, it is used to model the relationships among multiple variables. It has the capability of working with unobservable latent variables and can account for measurement error in the development of latent variable constructs (Chin, 1998).

However, variance-based PLS is technically different from covariance-based full-information SEM estimations, though they both can measure the structural relationship among latent constructs (Anderson and Gerbing, 1988). In the following sections, for description convenience, the covariance-based full-information SEM approach is referred to as “structural equation modeling” (SEM), whereas the variance-based approach is termed as “partial least square” (PLS).

There are several distinctions between SEM and PLS.

- The fundamental distinction is whether to use structural equation modeling for theory testing and development or for predictive applications (Anderson and Gerbing, 1988). In situations where prior theory is strong and further testing and development is the goal, SEM is more appropriate. Though PLS can also be used to test theories, it is more suitable for application and prediction.
- Estimation approaches

SEM uses a covariance-based approach to calculate path coefficients. This approach minimizes the differences between the sample covariance and those predicted by the theoretical model. PLS, on the other hand, uses a component-based approach, similar to principal components factor analysis (Compeau, et al., 1999). PLS calculates loadings between items and constructs, and regression coefficients between constructs.
- Estimation assumptions

The covariance-based approach, SEM, assumes multivariate normality, whereas variance-based PLS does not. Obviously, SEM requires multivariate normality

while “the PLS approach is distribution-free” (Wold, 1982, p.200). Thus, when the multivariate normality cannot be demonstrated, PLS is a preferable approach.

- Measurement assumptions

SEM assumes that observed measures have random error variance and measure-specific variance components, which are not of theoretical interest and are excluded from the measurement model (Anderson and Gerbing, 1988). Moreover, SEM assumes that the indicators used to measure latent variables (LV) are reflective in nature. This means that all items are affected by the same concept (e.g., LV) (Chin, 1998).

In contrast, PLS assumes that the explanation of all observed measure variance is useful. No random-error variance and measure-specific variance are assumed. Moreover, the PLS approach can measure both reflective and formative indicators. Formative indicators are assumed to be causes for latent variables.

- Estimation information and model complexity

The SEM approach can provide the most efficient parameter estimates and an overall test of model fit. Though estimations of PLS are not as efficient as full-information estimates (Fornell and Bookstein, 1982), PLS is considered better suited for explaining complex relationships (Fornell and Bookstein, 1982).

- Sample Size

The SEM approach requires a minimum sample size of 150, as a smaller sample size will reduce the statistical power. Moreover, when the sample size is small, normality assumption which is required by SEM might not be strictly demonstrated. However, as PLS can resample the initial data set and enlarge it 100 or 200 times, it does not require a large sample size. PLS sample size, which can be much smaller, can be equal to the larger of the following: (1) ten times the scale with the largest number of formative indicators or (2) ten times the largest number of structural paths directed at a particular construct in the structural model (Chin, 1998).

To sum up, SEM is theory-oriented confirmatory analysis, and PLS is primarily intended for predictive analysis in situations of high complexity but less strict statistical assumption (Wold, 1982).

In this study, though the research model was built upon a solid theoretical foundation, the model was relatively complex. Largely due to the difficulty in collecting data from decision-makers, the sample size was relatively small. Thus, in this study, PLS, compared with SEM, was more suitable. PLS Graph 3.0 was the software utilized to analyze data by using the PLS approach.

#### **4.3.5.2 Two-Step Approach**

PLS adopts a two-step approach to analyze the data (Anderson and Gerbing, 1988). First, a measurement model is evaluated to determine the validity and reliability of the measurement. Second, after adjustment of items and acceptance of the measurement model, a structural model is evaluated to assess the relationships of constructs.

The goal of assessing the measurement model is to ensure how well the items can measure the constructs they are intended to measure. The measurement model is evaluated by examining the individual loading of each item, internal composite reliability, and discriminant validity (Chin, 1998; Compeau, et al., 1999).

In a structural model, the hypotheses are tested by assessing the path coefficients “which are standardized betas” (Compeau, et al., 1999, p.152). Structural models can be developed in PLS using either a jackknife or bootstrap approach. Jackknifing is “an inferential technique that assesses the variability of a statistic by examining the variability of the sample data rather than using parametric assumptions” (Chin, 1998, p.318). In bootstrapping, “N sample sets are created in order to obtain N estimates for each parameter in the PLS model. Each sample is obtained by sampling with replacement from the original data set.” (Chin, 1998, p. 320) Chin (1998) stated that jackknife can be considered as an approximation of the bootstrap. These two methods do not show differences in co-efficiency of path in a generated structural model.

In this study, this two-step approach was adopted to analyze data collected from a quantitative study and bootstrapping was used to develop the structural model. In Chapter 5,

first, the demographic information of the data set is analyzed and presented. Then, the analysis results by using PLS, including measurement model and structural model, are presented and discussed in detail.

In the next chapter, first a thorough discussion of quantitative data analysis for validity and reliability is presented. Then the results from the analysis are provided and findings from the two surveys are discussed.

## **CHAPTER 5 DATA ANALYSIS AND RESULTS**

Two surveys were administered in order to investigate the ASP adoption decision. The first group of subjects is clients of LASP. The other group was made up of selected TCEs. For each survey study, first, the analysis of missing data and non-response bias is discussed. Second, sample characteristics are reported. Third, the measurement model (outer model) in PLS and statistical tests which are used to establish the validity and reliability of the survey instrument are presented. Fourth, the structural model (inner model) in PLS is analyzed to test the hypothesized relationship among decision factors presented in the research model. Finally, three moderating relationships are tested and the final results from the analysis are presented.

### **5.1 Survey One – Current ASP Clients (LASP’s clients)**

#### **5.1.1 Survey Response**

The first survey was conducted among LASP’s clients. In this section, survey response rate, missing data analysis, and non-response bias assessment are discussed.

##### **5.1.1.1 Survey Response Rate and Missing Value Analysis**

The total sample size was 221. Eighty-nine completed questionnaires were returned. This yielded an effective response rate of 40 percent.

Among these eighty-nine responses, five respondents indicated that they were non-ASP clients, though according to the client list provided by LASP, they were classified as LASP’s clients. These respondents might have had some misunderstanding about the ASP business model; thus, these responses were excluded from the total sample in order to ensure the validity of the results.

One response had a missing value of over 50 percent of the total questions. According to the criteria recommended by Hair, et al., (1998), variables with a missing value ratio larger than 30 percent should be removed. This response was therefore excluded from the data set. Other

than this particular excluded response, no other systematic missing values were encountered in this data set. Among the remaining data, only seven cases had a missing value of less than 2 percent on construct measuring variables. Hair, et al., (1998) stated that variables with a missing value ratio less than 10% can be retained in the dataset without missing value pattern assessment. So these cases were retained because they should not affect the overall results. Since PLS analysis usually works better on a data set with no missing values, the missing values in these seven cases were replaced with the mean, which is the most common solution to replacing missing values (Hair, et al., 1989).

Moreover, there were no demographic variables with more than 2 percent of the values missing except gross revenue, which had five missing values (6 percent). In this case, no correctional action for the missing data was taken.

After the removal of the above-mentioned unqualified cases and the clean-up of all missing values, the final usable sample size was 83.

#### **5.1.1.2 Non-Response Bias Assessment**

In research of this type, non-response bias assessment is even more important than the response rate (Grover, et al., 1996), because non-respondents may have a different view from respondents. Conclusions drawn only from respondents may differ from the actual situation in the population. The extrapolation method is recommended for predicting non-response bias (Hartman, et al., 1989; Churchill, 1991). This method is used to compare early respondents versus late respondents. Past research has shown that late respondents require multiple participation reminders and their actual responses are most often similar to non-respondents. Thus, if there are no significant differences between early respondents and late respondents, it is less likely that respondents will differ from non-respondents (Compeau and Higgins, 1995).

In this study, an extrapolation method was used to assess non-respondent bias. As Compeau and Higgins (1995) suggest, the midpoint of the data collection period, September 8th, was used as the cutoff point to distinguish early respondents from late respondents. Fifty-three out of 83 of the respondents (63.9 percent) were classified as early respondents, while 30 out of 83 of the respondents (36.1 percent) were classified as late respondents.

In order to ensure that the early respondents and late respondents did not differ systematically, these two groups were compared based on demographic data, including position of respondent, number of employees, number of IT professionals, previous outsourcing experiences, in-house maintenance experiences, industry, and size of city. The mean of each question was compared by conducting an independent sample t-test with the SPSS 11.5 (Compeau and Higgins, 1995).

By assessing Levene's test for equal variance, no significant variance differences existed for all the demographic variables ( $p < 0.05$ ). Thus, in this study, equal error variances were assumed for all the variables. As all the participants indicated their industry was banking, comparison was not conducted for the industry variable. No significant demographic differences were found between early respondents and late respondents at the alpha level of 0.05.

Further comparisons were conducted for all other questions in addition to demographic variables. One trust variable was slightly different between early respondents and late respondents. Among eighty-nine measurement variables, the effect of slight differences had no impact upon the results. Based on the assessment results (See Table 5-1), it was therefore determined that there was no significant response bias in this data set.

In addition, attempts were made to assess the demographic differences among respondents and non-respondents. In the list provided by the LASP, only email, location and name of clients were available. In regards to locations, both respondents and non-respondents were nearly equally distributed in all the states. Other than this comparison, no further comparisons were made.

Moreover, an attempt was also made to understand the causes of non-responses. During the reminder phone calls, several reasons for delay in participation or refusal to participate were identified. Roughly 34 percent of non-respondents indicated that they could not participate due to their companies' nonparticipation policy regarding survey research. Roughly another 23 percent said that they did not have time to complete the survey. For the remaining participants, voice messages were left after several unsuccessful attempts to solicit participation were made.

**Table 5-1 Non-response bias assessment in survey one: early respondents vs. late respondents**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>T-value</b>	<b>Df</b>	<b>Sig. (2-tailed)</b>
<b>Position</b>						
Early respondents	53	1.68	0.75	0.68	81	0.500
Late Respondents	30	1.57	0.68			
<b>Number of employees</b>						
Early respondents	53	3.42	0.84	1.30	81	0.199
Late Respondents	30	3.17	0.83			
<b>Number of IT professionals</b>						
Early respondents	51	1.82	1.09	0.97	79	0.333
Late Respondents	30	1.60	0.81			
<b>Gross revenue</b>						
Early respondents	49	3.49	1.98	-0.87	76	0.386
Late Respondents	29	3.90	2.01			
<b>Outsource experience</b>						
Early respondents	52	0.58	0.50	-1.74	80	0.085
Late Respondents	30	0.77	0.43			
<b>In-house main. Experience</b>						
Early respondents	53	0.64	0.48	0.37	81	0.711
Late Respondents	30	0.60	0.50			
<b>City size</b>						
Early respondents	51	4.86	1.82	0.72	79	0.473
Late Respondents	30	4.57	1.72			

In general, based on the available information, there was no indication of any significant non-respondents' biases.

### 5.1.2 Descriptive Analysis

LASP specializes in providing lending services to all kinds of financial institutions, such as banks, credit unions, etc., so, all the respondents in this study fell into the industry category of financial/banking industry.

This sample consisted of 51 percent executive managers (e.g. CEOs, CIOs, Vice Presidents of lending), 35 percent functional managers (e.g. consumer lending managers, lending managers), and 14 percent IT managers. All respondents were at the high management level in their respective organization.



Among the sample, forty-five organizations (54 percent ) had more than 500 employees that were classified as large companies, twenty-two organizations (26.51 percent) were medium companies (number of employees was within the range of 100 to 500), and sixteen organizations (19 percent ) were small (number of employees was less than 100). Hence, this sample consists of a nearly equal number of large companies and small or medium enterprises (SMEs).

The number of IT professionals in each organization varied. About forty-three organizations (52 percent) had less than twenty IT professionals, and twenty-six companies (31 percent) had twenty to thirty IT professionals employed. Twelve organizations (14 percent) had more than thirty IT professionals employed.

In this sample, there were twenty-nine companies (35 percent) having previous information systems outsourcing experience of some kind while fifty-three companies (64 percent) had no IS outsourcing experience. About fifty-two organizations (63 percent) at some time had maintained the systems in-house which they outsourced later. The remaining thirty-one organizations had no experience maintaining the systems that they previously or currently outsourced. Hence, in this data set, all companies from the different categories of these demographic variables were relatively well represented.

The gross revenue of organizations was almost equally distributed across all categories as well, from less than \$5 million to more than \$1 billion. The median number was between \$10,100,000 to \$ 20 million.

The size of the city where a company was located was also equally distributed among all the city size categories, from small cities with less than 50,000 residents, to very large cities with more than 1,000,000 residents. The medium number of city size fell into the category of 250,000 to 499,000 residents.

Table 5-2 summarizes all these sample characteristics.

### **5.1.3 Measurement Model and Validity and Reliability Testing**

A two-step model testing approach, using a measurement model and a structural model, was adopted in this study. The measurement model was used to assess and develop the reliability

**Table 5-2 Responses to categorical demographic questions in survey one**

	<b>Category</b>	<b>Number</b>	<b>Percent</b>
<b>Positions</b>	Executive manager	42	50.60
	Functional manager	29	34.94
	IS/IT manager	12	14.46
<b>No. of Employees</b>	Less than 20	2	2.41
	20-99	14	16.87
	100-500	22	26.51
	More than 500	45	54.22
<b>No. of IT Professionals</b>	Less than 10	43	51.81
	11-30	26	31.33
	31-50	2	2.41
	More than 50	10	12.05
	not report	2	2.41
<b>Outsourcing Experience</b>	No	29	34.94
	Yes	53	63.86
	not report	2	2.41
<b>In-house Maintenance Experience</b>	No	31	37.35
	Yes	52	62.65
<b>Gross Revenue</b>	Less than \$5 million	13	15.66
	\$5 million --- \$10 million	14	16.87
	\$10.1 million --- \$20 million	17	20.48
	\$20.1 million --- \$50 million	4	4.82
	\$50.1 million --- \$100 million	10	12.05
	\$100.1 million --- \$500 million	16	19.28
	\$500.1 million --- \$1 billion	2	2.41
	more than \$1 billion	2	2.41
	not report	5	6.02
<b>City Size</b>	10,000 --- 49,999	11	13.25
	50,000 --- 99,999	13	15.66
	100,000 --- 249,999	13	15.66
	250,000 --- 499,999	13	15.66
	500,000 --- 999,999	10	12.05
	1,000,000 or more	21	25.30
	not report	2	2.41
<b>Total</b>		<b>83</b>	<b>100.00</b>

and validity of the instrument. This model examined the relationship between items and the constructs they were supposed to measure. Then, the structural model was conducted to assess hypothesized relationships in the conceptual model. In the structural model, the correlations between different constructs were examined by looking at significance of path loadings.

In this section, the steps that were conducted to ensure the validity and reliability of the instruments are presented. First, the normal distribution and outliers are discussed. Second, the measurement model (outer model) in PLS is presented, followed by a discussion of reliability and discriminant validity testing.

#### **5.1.3.1 Assessment of Normal Distribution and Outliers**

The normality of all nonparametric variables was assessed by plotting histograms and normal probability plots. In addition, the Kolmogorov-Smirnov goodness-of-fit test, as recommended by Hair, et al., (1998) was performed. The SPSS 11.5 was used to conduct all of these statistical tests.

In histograms and plots, the normal distribution should be indicated by residuals adhering to a straight diagonal line in the center of the graph. Upon examining the plots of the variables in this study, some appeared to be normally distributed, while others did not.

With the Kolmogorov-Smirnov test, if responses to a variable are normally distributed, the p-value should be non-significant (larger than 0.05). In this data set, the significant p-values (less than 0.05) indicate that the distribution of all the variables differed significantly from a normal distribution. Thus, normal distribution assumption did not hold for the variables in this study. However, PLS was employed for data analysis. It is relatively “forgiving” for data which may violate the normality assumption. Moreover, in this study, outliers were not a concern, as the Likert scale was used for measurement. It was reasonable to have answers at every scale level.

#### **5.1.3.2 Assessment of the Measurement (Outer) Model**

Reliability and validity are two criteria to assess measurement. A reliable measurement refers to the instrument that can report the same results repeatedly. If an instrument does not have the required reliability, it is hard to tell whether the findings drawn from the data are due to the actual effect under study or to the measurement error. Validity assessment is also important, as valid measurements can ensure that indicators measure what they are supposed to measure. Thus, the findings from the analyzed results can confidently reflect the conceptual model in actual situations.

In this study, before the hypothesized relationships were tested, the measurement model was evaluated in PLS Graph to assess the reliability and discriminant validity. Several statistical techniques were adopted to achieve good reliability and discriminant validity of instruments.

### 5.1.3.2.1 Factor Analysis

Factor analysis is a multivariate statistical technique used to analyze the structure of the correlations among a large number of variables (Hair, et al., 1998). Factor analysis can help to identify the total number of factors in an analysis and the extent to which these factors can be explained by each variable.

Before a factor model is processed, the items must be specified. Generally, there are two types of specifications for the measurement model: reflective and formative. Each requires different statistical techniques for analysis. The distinct differences between these two types of measurement are shown in Table 5-3 (Jarvis, et al., 2003; Chin, 1989).

**Table 5-3 Comparison of formative model and reflective model (taken from Jarvis, et al., 2003)**

	<b>Formative model</b>	<b>Reflective model</b>
1. Direction of causality from construct to measure implied by the conceptual definition	Direction of causality is from items to construct	Direction of causality is from construct to items
Would changes in the indicators/items cause changes in the construct or not?	Changes in the indicators should cause changes in the construct	Changes in the indicators should not cause changes in the construct
Would changes in the construct cause changes in the indicators?	Changes in the construct do not cause changes in the indicators	Changes in the construct do cause changes in the indicators
2. Interchangeability of the indicators/items	Indicators need not be interchangeable	Indicators should be interchangeable
Do the indicators share a common theme	Indicators need not share a common theme	Indicators should share a common theme
Would dropping one of the indicators alter the conceptual domain of the construct?	Dropping an indicator may alter the conceptual domain of the construct.	Dropping an indicator should not alter the conceptual domain of the construct
3. Covariation among the indicators	Not necessary for indicators to covary with each other	Indicators are expected to covary with each other
Should a change in one of the indicators be associated with changes in the other indicators?	Not necessary	Yes
4. Nomological net of the construct indicators	Nomological net for the indicators may differ	Nomological net for the indicators should not differ
Are the indicators/items expected to have the same antecedents and consequences?	Indicators are not required to have the same antecedents and consequences	Indicators are required to have the same antecedents and consequences

For reflective measures, all the indicators are expected to correlate strongly with the construct that they are supposed to measure, but not with any other construct. However, as formative indicators are not required to covary with each other, a high correlation among different items may not exist. Hence, factor analysis is suitable to assess measurement of the reflective measurement model.

According to these decision rules, it was determined that all of the measurements developed in this study were reflective measures. The changes in the common construct caused the change of each item. These indicators were interchangeable. All the indicators covaried with each other, and they were assumed to have the same antecedents and consequences. Moreover, the previous pretest and pilot test had confirmed strong correlations among the indicators that were supposed to measure the same construct. Thus, factor analysis was suitable to initially check the reliability and validity of the measurement in this study.

Exploratory factor analysis (EFA) was conducted to assess the reliability of instruments. Sixty-three items were analyzed regarding dimensionality. Based on the theories and the established ASP adoption model, nine dimensions were initially identified. EFA was performed in SPSS, and the principal components method with varimax rotation was used. A series of criteria for removing an item was checked sequentially for each item (Hair, et al., 1998).

- Examine communality and remove items having communality values less than 0.450.
- Examine MSA (measures of sampling adequacy) in the anti-image matrix and remove items with values less than 0.50.
- Examine loadings and remove items that can not load together with other items.
- Examine loadings and remove items with values less than 0.5
- Examine loadings and remove items that double load on more than two factors.  
(Note: Double loading means that one item has more than two factor loadings larger than 0.5)

This removal process removed only one item at a time. After the removal of that item, the removal process was repeated again to remove the next item. In total, 10 items were removed through this assessment process. The exact removed items and reasons for dropping them are listed in Table 5-4.

**Table 5-4 Items dropped during exploratory factor analysis in survey one**

<b>Construct</b>	<b>Dropped Items</b>	<b>Reason</b>
Uncertainty	Government police (UNCA2)	Low communality (0.420) and low MSA value (0.29)
	Technology change (UNCA6)	Low MSA value (0.387)
Cost Benefits	Save switch cost (COS9)	Low communality (0.420) and low MSA value
	Save hardware cost (COS1)	Low loading (0.411)
ASP adoption	Adoption way (ADPWAY)	Low MSA value (0.105)
Relationship	ASP managers known to us (REL1)	Low MSA value (0.329)
	ASP known to us (REL2)	Loading less than 0.45
Capability	Partnering with other vendors (CAP10)	Low MSA value (0.427)
	Maintain system 24*7 (CAP7)	Low loading (0.48)
Importance	Impact customers (CUSINT)	Low MSA value (0.389)

After this iterative removal process, 53 items were kept for further data analysis. In the factor analysis, indicators of asset specificity were loaded separately in two factors. By referring to the questionnaires, it was found that ASS1 to ASS4 were measuring the required special investment from an ASP in order to provide unique applications desired by a client, while ASS5 to ASS8 were measuring resource uniqueness of a company from an internal perspective. It seemed that ASS1 to ASS4 were used to measure asset specificity from an external perspective, and ASS5 to ASS8 were used to measure asset specificity from a company's internal perspective. Thus, it was reasonable to divide the measurement of asset specificity into two groups, represented by two factors. These two factors were named ASSE (asset specificity external) and ASSI (asset specificity internal).

Factor loadings and dimensionality distinction supported the initial reliability and discriminant validity. All the items loaded well on the constructs that they were intended to measure. There were no significant double-loading problems. Moreover, Cronbach's Alpha was calculated in SPSS for each construct to assess reliability. It is calculated based on the average inter-item correlation. All the constructs had a Cronbach's alpha higher than 0.75. Hence, the reliability of this instrument was supported as well. The factor loadings of all the items and Cronbach's Alpha are reported in Table 5-5.

#### **5.1.3.2.2 Measurement Model**

After analyzing the dimensionality of all the measurements in EFA, the measurement model was analyzed in PLS Graph to further assess the reliability of the instruments.

**Table 5-5 Loadings in exploratory factor analysis and Cronbach's alpha in survey one**

	UNCA	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT	Alpha
UNCA1	<b>0.506</b>	0.093	0.032	-0.215	0.034	0.385	-0.134	-0.223	0.158	-0.064	0.77
UNCA3	<b>0.805</b>	0.073	0.078	0.126	0.101	-0.128	-0.120	-0.012	0.026	0.076	
UNCA4	<b>0.784</b>	-0.111	-0.124	0.186	0.105	-0.211	-0.107	-0.151	-0.092	0.010	
UNCA5	<b>0.733</b>	-0.118	-0.134	-0.147	-0.149	0.082	0.025	-0.005	0.088	-0.027	
UNCA7	<b>0.523</b>	0.069	-0.037	-0.215	0.048	0.182	-0.234	0.036	-0.084	0.126	
UNCA8	<b>0.652</b>	0.047	-0.142	-0.143	-0.089	0.139	0.080	-0.112	-0.055	-0.147	
ASS1	-0.090	<b>0.763</b>	0.111	-0.111	-0.046	0.072	0.036	0.163	0.019	0.010	0.88
ASS2	-0.026	<b>0.752</b>	0.261	-0.162	-0.075	0.107	0.115	0.117	0.100	0.129	
ASS3	0.059	<b>0.731</b>	0.300	-0.105	-0.080	0.227	0.170	-0.060	0.245	0.002	
ASS4	0.149	<b>0.621</b>	0.358	-0.052	-0.260	0.265	0.138	-0.159	0.252	0.038	
ASS5	-0.134	0.154	<b>0.816</b>	0.148	-0.006	0.129	0.030	0.077	0.033	0.008	0.88
ASS6	-0.104	0.159	<b>0.833</b>	0.118	-0.114	0.138	0.024	0.127	0.019	0.103	
ASS7	-0.137	0.074	<b>0.870</b>	0.041	-0.088	0.095	0.006	0.075	0.001	-0.025	
ASS8	0.059	0.321	<b>0.717</b>	0.047	0.102	0.149	0.070	-0.197	0.118	0.039	
COS2	-0.070	-0.022	-0.071	<b>0.736</b>	0.134	-0.048	0.009	0.160	0.006	0.024	0.9
COS3	-0.090	0.005	0.139	<b>0.771</b>	0.295	0.098	-0.015	-0.086	-0.026	0.134	
COS4	-0.104	-0.008	0.042	<b>0.777</b>	0.293	0.075	-0.045	0.038	-0.182	0.094	
COS5	-0.093	-0.063	0.144	<b>0.764</b>	0.234	0.065	-0.073	-0.045	0.120	0.004	
COS6	0.048	-0.082	0.041	<b>0.779</b>	0.099	-0.030	0.094	0.053	0.073	0.023	
COS7	0.067	-0.307	0.252	<b>0.582</b>	0.356	-0.124	0.293	-0.024	0.192	-0.008	
COS8	0.012	-0.348	0.093	<b>0.616</b>	0.276	-0.176	0.245	-0.051	-0.024	0.224	0.94
DEF1	-0.019	-0.031	-0.058	0.263	<b>0.849</b>	0.036	0.094	-0.075	-0.049	0.041	
DEF2	0.041	-0.100	0.020	0.259	<b>0.807</b>	-0.060	0.055	-0.043	-0.215	0.071	
DEF3	-0.018	-0.037	-0.112	0.177	<b>0.831</b>	-0.047	0.130	-0.095	-0.167	0.082	
DEF4	-0.002	-0.143	-0.116	0.439	<b>0.638</b>	-0.048	0.114	0.122	-0.253	0.077	
DEF5	-0.017	-0.044	0.001	0.017	<b>0.859</b>	0.027	0.135	0.206	0.041	0.022	
DEF6	0.000	-0.031	-0.012	0.172	<b>0.866</b>	-0.087	0.135	0.171	-0.111	0.064	
DEF7	0.025	-0.051	0.030	0.255	<b>0.770</b>	-0.040	0.001	0.093	0.124	0.155	
IMP1	0.066	0.193	0.123	-0.117	-0.156	<b>0.771</b>	0.336	0.113	0.211	0.072	0.93
IMP2	-0.168	0.132	0.143	-0.090	-0.139	<b>0.789</b>	0.304	0.112	0.219	0.075	
IMP3	-0.016	0.220	0.160	-0.049	-0.100	<b>0.817</b>	0.239	0.079	0.239	0.068	
IMP4	0.143	0.029	0.250	0.405	0.020	<b>0.708</b>	0.207	0.019	0.029	0.153	
IMP5	0.074	0.086	0.091	0.061	0.090	<b>0.877</b>	0.127	0.067	0.090	0.077	
CAP1	-0.116	-0.141	0.034	0.054	-0.050	0.228	<b>0.763</b>	-0.093	0.144	-0.019	0.87
CAP2	-0.178	-0.070	0.053	0.037	0.020	0.078	<b>0.795</b>	-0.030	-0.041	0.122	
CAP3	-0.018	0.018	0.076	-0.148	0.165	0.180	<b>0.767</b>	0.106	0.135	0.030	
CAP4	-0.064	0.047	-0.064	0.023	0.186	0.255	<b>0.692</b>	0.010	0.126	-0.027	
CAP5	-0.042	0.104	-0.042	-0.002	0.264	0.020	<b>0.709</b>	0.071	0.181	0.096	
CAP6	0.118	0.392	0.052	0.129	-0.130	0.228	<b>0.599</b>	-0.006	0.198	0.096	
CAP8	-0.047	0.107	0.053	0.205	0.099	-0.131	<b>0.539</b>	0.195	-0.068	-0.119	
CAP9	0.065	0.261	0.021	0.034	0.088	0.230	<b>0.648</b>	0.177	0.087	0.061	

(Table 5-5 cont.)

	UNCA	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT	Alpha
REL3	-0.156	-0.031	0.013	0.042	0.057	-0.065	0.103	<b>0.718</b>	0.201	0.292	0.75
REL4	-0.062	0.082	0.102	-0.066	0.035	0.228	0.149	<b>0.757</b>	-0.081	-0.027	
REL5	-0.067	0.102	0.007	0.135	0.155	0.075	0.021	<b>0.810</b>	0.065	0.047	
TRU1	-0.073	-0.226	0.085	0.195	-0.026	0.057	0.245	0.171	<b>0.587</b>	0.299	0.88
TRU2	0.001	0.013	-0.015	-0.017	0.026	0.094	0.196	0.249	<b>0.813</b>	0.095	
TRU3	0.051	0.018	0.118	-0.020	-0.109	0.116	0.195	0.085	<b>0.844</b>	0.008	
TRU4	-0.021	0.043	0.091	0.184	-0.103	0.113	0.137	-0.171	<b>0.733</b>	0.000	
TRU5	0.028	0.286	0.008	-0.121	-0.108	0.150	0.041	0.057	<b>0.779</b>	0.067	
TRU6	-0.067	0.318	-0.074	-0.075	-0.115	0.178	-0.100	-0.146	<b>0.770</b>	-0.016	
APPTOTAL	0.084	0.036	0.246	0.271	0.303	0.141	-0.100	-0.067	0.215	<b>0.507</b>	0.78
ADPPERC	0.007	0.039	0.055	0.124	0.123	0.084	0.100	0.103	0.024	<b>0.885</b>	
ADPBUDG	-0.041	0.098	-0.048	0.057	0.151	0.129	0.077	0.146	0.110	<b>0.864</b>	

The measurement model assumes a confirmatory factor analysis (CFA), which differs from exploratory factor analysis. Confirmatory factor analysis requires researchers to specify factor structures, while exploratory factor analysis can produce a factor structure by itself according to a correlation or covariance matrix (Netemeyer, et al., 2003). Netemeyer, et al., (2003) suggest that CFA can be performed after EFA to further examine the dimensionality. CFA is therefore used to validate the established dimensionality of scales and to disclose measurement problems.

In PLS Graph, the measurement model is used to assess the adequacy of the measures. PLS Graph 3.0 can generate weights and loadings for each item specified to measure a certain construct.

The loadings in the measurement model are used to test the reliability of each item. High loadings ensure that all items are measuring the same construct. Chin (1998) identifies the loading criteria: “standardized loadings should be greater than 0.707... But it should also be noted that this rule of thumb should not be as rigid at earlier stages of scale development. Loading of 0.5 or 0.6 may still be acceptable if there are additional indicators in the block.” In some cases, when the instrument is developed under a specific context and applied to a different context, the loadings may become lower (Barclay, Higgins and Thompson, 1995).



The weights are regression beta coefficients of each item on their specified latent construct. Weights are used to calculate latent variable scores for each latent construct. Especially in formative measures, the weights reflect the contribution of each item to its latent construct. Weights are useful to assess the reliability of the formative indicators.

Hence, in this study, with this rule of thumb in mind, item loadings were assessed by referring to the conceptual domain of each construct. PLS Graph 3.0 was used to perform the measurement model. Two items were further removed from this initial measurement due to low loadings.

When assessing the loadings, it was found that UNCA3 (extent of change in business practice required by companies to remain competitive in an industry) and UNCA4 (extent of change in client requirements/needs in an industry) had a much higher correlation, compared with any other items measuring uncertainty. When these two items were specified together, separate from the rest of the items, overall loadings of uncertainty items and the  $R^2$  of Trust improved. Meanwhile, the survey questions for uncertainty were examined to explore possible reasons for this separate loading. UNCA3 (extent of change in business practice required by companies to remain competitive in an industry) and UNCA4 (extent of change in client requirements/needs in an industry) examined the external environment change at a micro level. These two questions were most closely associated with specific companies. However, the rest of the items were more likely to examine environmental change at a macro level. As a result, two different sub-constructs of uncertainty were formed that were measured by these two sets of items, in order to increase the explained variance, and to distinguish uncertainty at a micro and macro level. They were named UNCAMI (micro-level) and UNCAMA (macro-level).

The initial and final loadings and weights of each item on its specified construct are presented in Table 5-6.

### **5.1.3.3 Assessment of Reliability**

In Table 5-6, all of the indicators have loadings higher than or close to 0.7, demonstrating that all of the measurements met the requirements for reliability prescribed by

**Table 5-6 Loadings and weights of measurement model and composite reliability in survey one**

Construct	Original Model			Refined Model		
	Variable	Weight	Loading	Weight	Loading	Composite reliability
<b>Uncertainty-MA (UNCAMA)</b>	UNCA1	0.3374	0.6981	0.3374	0.6981	0.81
	UNCA5	0.3538	0.735	0.3538	0.735	
	UNCA7	0.3818	0.6866	0.3818	0.6866	
	UNCA8	0.3212	0.7542	0.3212	0.7542	
<b>Uncertainty-MI (UNCAMI)</b>	UNCA3	-0.4055	-0.9008	-0.4055	-0.9008	0.93
	UNCA4	-0.6587	-0.9636	-0.6587	-0.9636	
<b>Asset Specificity -- external (ASSE)</b>	ASS1	0.3033	0.8129	0.3033	0.8129	0.915
	ASS2	0.3191	0.8771	0.3191	0.8771	
	ASS3	0.2938	0.8928	0.2938	0.8928	
	ASS4	0.2537	0.8325	0.2537	0.8325	
<b>Asset Specificity -- internal (ASSI)</b>	ASS5	0.4184	0.9171	0.4184	0.9171	0.919
	ASS6	0.2814	0.8993	0.2814	0.8993	
	ASS7	0.2132	0.8531	0.2132	0.8531	
	ASS8	0.2383	0.7607	0.2384	0.7607	
<b>Cost Benefits (COS)</b>	COS2	0.1279	0.7158	0.1279	0.7158	0.921
	COS3	0.2037	0.8307	0.2037	0.8307	
	COS4	0.1874	0.8221	0.1874	0.8221	
	COS5	0.1744	0.8074	0.1745	0.8074	
	COS6	0.1638	0.7628	0.1638	0.7628	
	COS7	0.1848	0.7845	0.1848	0.7845	
	COS8	0.2182	0.7994	0.2182	0.7994	
<b>Deficiency Removal (DEF)</b>	DEF1	0.1653	0.8961	0.1653	0.8961	0.951
	DEF2	0.1494	0.8622	0.1494	0.8622	
	DEF3	0.1551	0.8628	0.1551	0.8628	
	DEF4	0.145	0.7978	0.145	0.7978	
	DEF5	0.1576	0.8366	0.1576	0.8366	
	DEF6	0.1749	0.9087	0.1749	0.9087	
	DEF7	0.2182	0.8375	0.2182	0.8375	
<b>Importance (IMP)</b>	IMP1	0.1603	0.885	0.1604	0.885	0.948
	IMP2	0.1797	0.8825	0.1797	0.8825	
	IMP3	0.2147	0.9163	0.2147	0.9163	
	IMP4	0.333	0.8537	0.333	0.8537	
	IMP5	0.2448	0.8927	0.2447	0.8927	
<b>Capability (CAP)</b>	CAP1	0.2072	0.7685	0.2128	0.7758	0.908
	CAP2	0.113	0.7365	0.1218	0.741	
	CAP3	0.1966	0.825	0.2024	0.8318	
	CAP4	0.1768	0.7549	0.1796	0.7568	
	CAP5	0.182	0.7648	0.1845	0.7609	
	CAP6	0.2324	0.7275	0.2298	0.7212	
	CAP8	0.0393	0.4605	Removed		
	CAP9	0.1774	0.7638	0.1769	0.7586	
<b>Relationship (REL)</b>	REL3	0.6272	0.9058	0.6279	0.9061	0.842
	REL4	0.2013	0.6829	0.2008	0.6825	
	REL5	0.3703	0.7951	0.3699	0.7948	

(Table 5-6 cont.)

Construct	Variable	Original Model		Refined Model		
		Weight	Loading	Weight	Loading	Composite reliability
<b>Trust (TRU)</b>	TRU1	0.3131	0.754	0.3274	0.7712	0.901
	TRU2	0.3084	0.8736	0.3214	0.8732	
	TRU3	0.2197	0.8754	0.2288	0.8716	
	TRU4	0.1417	0.7374	0.1475	0.7349	
	TRU5	0.2002	0.7762	0.2089	0.7614	
	TRU6	0.0624	0.6779	Removed		
<b>Adoption (ADOPT)</b>	ADPPERC	0.357	0.8614	0.3575	0.8617	0.869
	ADPBURG	0.369	0.8523	0.3691	0.8525	
	APPTOTAL	0.488	0.7744	0.4874	0.7741	

Chin (1998). The above measurement model indicated that the instrument used was adequate for measuring each construct individually.

Moreover, as another indicator, the internal composite reliability (ICR) score is recommended to assess the reliability of the reflective measurement (Chin, 1998). ICR is different from Cronbach's Alpha, which weighs all of the items equally without factor loading considerations. The formula to calculate the composite reliability score is (Werts et al. 1974, Chin, 1998) as follows:

$$\rho_c = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum (1 - \lambda_i^2)}$$

Where  $\lambda_i$  = the component loading of each item to a latent construct

$$\sum_i var(\varepsilon_i) = 1 - \lambda_i^2$$

The value of 0.7 or higher is recommended for a composite reliability score (Fornell and Larcker, 1981). In the measurement model for this study, composite reliability of every construct was higher than 0.8 (see Table 5-6).

In addition to item loadings and ICR, another measure of reliability is average variance extracted (AVE). This is particularly useful for latent construct measurement. AVE is the

average of the squared loading of each item on a construct. It is used to assess how well a theoretical latent construct explains the variance of a set of items that are supposed to measure this construct. In other words, AVE is used to measure the amount of variance captured by the indicators of a construct versus the amount of variance caused by the measurement error.

The formula used to calculate AVE is:

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum (1 - \lambda_i^2)}$$

Where  $\lambda_i$  = the component loading of each item to a latent construct

Fornell and Larcker (1981) stated that AVE should be higher than 0.5. This means that at least 50 percent of measurement variance is captured by the construct.

PLS Graph can generate all the AVEs in the output. In this study, AVEs of all the constructs were larger than 0.5. Hence, after passing all these assessments, it was determined that this instrument had achieved an acceptable level of reliability.

#### **5.1.3.4 Assessment of Discriminant Validity**

Besides the reliability check, the next step was to examine discriminant validity by means of analyzing cross-loadings and average variance extracted (AVE). There were two rules to follow (Chin, 1998):

- 1) Items should have a higher correlation with the construct that they are supposed to measure than with any other constructs in the model.
- 2) The square root of AVE of each construct should be larger than the correlation of the two constructs (Staples, et al., 1999).

Firstly, cross loading was examined for discriminant validity. A cross-loading check was performed using PLS Graph 3.0 and SPSS 11.5. PLS Graph 3.0 was used to generate the latent variable scores for each item on all the latent constructs remaining in the refined model. After the raw scores of all the items had been standardized in SPSS, SPSS 11.5 was used to

calculate the Pearson's correlation coefficients for all the items against the latent variable scores. The correlation results were computed and are presented in Table 5-7.

In the table, all the items loaded higher on the construct that they were supposed to measure than on any other constructs. No items loaded at more than 0.707 on any other construct that they were not theoretically specified to measure. This cross-loading check indicated that all fifty-two items loaded uniquely on the specified constructs.

Second, besides the cross-loading check, the AVE and PHI Matrix also were used for discriminant validity assessment. PHI matrix is a set of correlations between the latent factors that are specified in the model. The test is to compare the correlation between any two constructs with the average squared root of AVEs of these two constructs. The test requires that the correlation be smaller than the average of the two root-squared AVEs. Stricter requirements of this test even ask that the correlations be smaller than both the squared roots of AVE (Staples et al, 1999).

The results of the discriminant validity analysis are displayed in Table 5-8. Diagonal elements, which should be larger than any other corresponding row or column elements, show the square root of the AVE, whereas the off-diagonal elements show the PHI matrix of latent construct correlations. In this study, there was no correlation between any two latent constructs larger than or even equal to the square root AVEs of these two constructs. Most of the correlations were far below the square root of AVEs. Consequently, the results demonstrated that all constructs in the model were indeed different from each other. Discriminant validity was supported in this measurement.

After all these reliability and validity checks, the instruments presented a satisfactory measurement model.

#### **5.1.4 Structural Model**

After the evaluation of the measurement model, the structural model was used to test the independent relationship among the constructs, which were proposed in the conceptual model presented in Chapter 3 (see Figure 3-1).

**Table 5-7 Cross-loadings assessment in survey one**

	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
UNCA1	<b>0.698</b>	-0.192	0.167	0.051	-0.189	-0.133	0.260	-0.007	-0.205	0.083	0.023
UNCA3	0.455	<b>-0.901</b>	0.028	-0.023	0.083	0.117	-0.045	-0.134	-0.069	-0.006	0.112
UNCA4	0.430	<b>-0.964</b>	-0.224	-0.237	0.135	0.162	-0.207	-0.200	-0.258	-0.161	0.007
UNCA5	<b>0.735</b>	-0.459	-0.031	-0.203	-0.198	-0.158	0.067	-0.007	-0.173	0.069	-0.047
UNCA7	<b>0.687</b>	-0.329	0.077	-0.078	-0.214	-0.040	0.082	-0.156	-0.079	-0.084	0.080
UNCA8	<b>0.754</b>	-0.358	0.066	-0.171	-0.180	-0.129	0.076	0.031	-0.177	-0.058	-0.165
ASS1	-0.009	0.167	<b>0.813</b>	0.255	-0.199	-0.115	0.225	0.129	0.169	0.107	0.030
ASS2	0.086	0.195	<b>0.877</b>	0.374	-0.209	-0.169	0.293	0.253	0.184	0.190	0.198
ASS3	0.081	0.080	<b>0.893</b>	0.431	-0.193	-0.168	0.443	0.314	0.020	0.311	0.115
ASS4	0.187	0.000	<b>0.832</b>	0.473	-0.167	-0.325	0.454	0.272	-0.068	0.301	0.119
ASS5	-0.139	0.177	0.355	<b>0.917</b>	0.214	-0.013	0.289	0.140	0.156	0.122	0.179
ASS6	-0.171	0.160	0.397	<b>0.899</b>	0.144	-0.091	0.344	0.107	0.185	0.140	0.215
ASS7	-0.174	0.220	0.310	<b>0.853</b>	0.109	-0.106	0.264	0.070	0.049	0.085	0.091
ASS8	0.019	-0.001	0.489	<b>0.761</b>	0.122	0.035	0.333	0.185	-0.058	0.157	0.195
COS2	-0.180	-0.013	-0.172	0.062	<b>0.716</b>	0.339	0.006	0.054	0.215	0.024	0.204
COS3	-0.232	-0.090	-0.087	0.243	<b>0.831</b>	0.463	0.153	0.075	0.056	0.060	0.347
COS4	-0.241	-0.064	-0.180	0.149	<b>0.822</b>	0.480	0.083	0.012	0.131	-0.104	0.291
COS5	-0.200	-0.061	-0.122	0.227	<b>0.807</b>	0.375	0.105	0.028	0.096	0.114	0.252
COS6	-0.227	-0.150	-0.138	0.087	<b>0.763</b>	0.324	0.103	0.122	0.098	0.108	0.216
COS7	-0.182	-0.137	-0.205	0.182	<b>0.784</b>	0.509	0.062	0.260	0.086	0.218	0.224
COS8	-0.239	-0.137	-0.325	0.044	<b>0.799</b>	0.487	-0.041	0.158	0.062	0.049	0.347
DEF1	-0.136	-0.132	-0.202	-0.024	0.490	<b>0.896</b>	0.018	0.166	0.039	-0.060	0.275
DEF2	-0.102	-0.189	-0.256	-0.019	0.500	<b>0.862</b>	-0.078	0.068	0.065	-0.201	0.248
DEF3	-0.134	-0.148	-0.223	-0.119	0.424	<b>0.863</b>	-0.069	0.142	0.032	-0.161	0.258
DEF4	-0.238	-0.198	-0.284	-0.117	0.587	<b>0.798</b>	-0.048	0.092	0.171	-0.181	0.241
DEF5	-0.071	-0.011	-0.078	-0.022	0.333	<b>0.837</b>	0.044	0.217	0.301	0.020	0.262
DEF6	-0.149	-0.117	-0.171	-0.029	0.456	<b>0.909</b>	-0.068	0.176	0.235	-0.097	0.290
DEF7	-0.124	-0.136	-0.144	0.026	0.492	<b>0.838</b>	0.022	0.103	0.192	0.098	0.362
IMP1	0.235	0.197	0.475	0.272	-0.139	-0.180	<b>0.885</b>	0.531	0.185	0.380	0.172
IMP2	0.031	0.362	0.450	0.297	-0.096	-0.161	<b>0.883</b>	0.498	0.212	0.401	0.193
IMP3	0.146	0.198	0.488	0.336	-0.077	-0.138	<b>0.916</b>	0.464	0.173	0.396	0.230
IMP4	0.122	-0.020	0.242	0.362	0.383	0.129	<b>0.854</b>	0.370	0.105	0.241	0.357
IMP5	0.212	0.091	0.262	0.259	0.055	0.073	<b>0.893</b>	0.386	0.116	0.254	0.263
CAP1	-0.113	0.169	0.101	0.088	0.122	0.037	0.385	<b>0.776</b>	0.072	0.328	0.028
CAP2	-0.191	0.203	0.085	0.103	0.159	0.130	0.265	<b>0.741</b>	0.146	0.188	0.096
CAP3	0.016	0.211	0.215	0.115	0.039	0.165	0.363	<b>0.832</b>	0.236	0.312	0.115
CAP4	-0.045	0.136	0.166	0.030	0.137	0.198	0.378	<b>0.757</b>	0.142	0.277	0.142
CAP5	-0.084	0.150	0.145	0.027	0.164	0.290	0.251	<b>0.761</b>	0.172	0.285	0.209
CAP6	0.065	0.084	0.425	0.230	0.060	-0.052	0.489	<b>0.721</b>	0.077	0.354	0.185
CAP9	-0.008	0.060	0.289	0.170	0.056	0.147	0.439	<b>0.759</b>	0.254	0.273	0.152
REL3	-0.231	0.174	0.040	0.076	0.123	0.134	0.082	0.165	<b>0.901</b>	0.312	0.318
REL4	-0.104	0.168	0.169	0.147	-0.043	0.068	0.283	0.218	<b>0.689</b>	0.106	0.069
REL5	-0.141	0.147	0.102	0.097	0.157	0.210	0.156	0.144	<b>0.801</b>	0.192	0.194

(Table 5-7 cont.)

	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
TRU1	-0.157	0.072	0.073	0.088	0.283	0.056	0.264	0.320	0.292	<b>0.771</b>	0.363
TRU2	0.028	0.112	0.198	0.073	0.021	-0.008	0.290	0.355	0.370	<b>0.873</b>	0.246
TRU3	0.057	0.062	0.270	0.165	-0.009	-0.164	0.336	0.325	0.192	<b>0.872</b>	0.143
TRU4	0.018	0.096	0.217	0.160	0.143	-0.109	0.288	0.279	-0.031	<b>0.735</b>	0.125
TRU5	0.134	0.101	0.382	0.155	-0.164	-0.219	0.293	0.257	0.157	<b>0.761</b>	0.191
APPTOTAL	-0.005	-0.132	0.145	0.260	0.402	0.322	0.252	0.059	0.109	0.261	<b>0.774</b>
ADPPERC	-0.044	-0.006	0.071	0.140	0.244	0.243	0.225	0.195	0.286	0.185	<b>0.862</b>
ADPBUDG	-0.035	0.046	0.108	0.066	0.176	0.229	0.248	0.205	0.346	0.260	<b>0.853</b>

**Table 5-8 Correlations between latent constructs (PHI matrix) and square root of AVE comparison in survey one**

	AVE	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
UNCAMA	0.517	<b>0.719</b>										
UNCAMI	0.87	-0.468	<b>0.933</b>									
ASSE	0.73	0.096	0.137	<b>0.855</b>								
ASSI	0.739	-0.139	0.166	0.443	<b>0.86</b>							
COS	0.624	-0.274	-0.123	-0.226	0.182	<b>0.79</b>						
DEF	0.736	-0.157	-0.154	-0.221	-0.045	0.546	<b>0.858</b>					
IMP	0.785	0.167	0.155	0.407	0.353	0.085	-0.027	<b>0.886</b>				
CAP	0.584	-0.054	0.186	0.281	0.148	0.132	0.160	0.492	<b>0.764</b>			
REL	0.642	-0.217	0.198	0.099	0.114	0.126	0.176	0.168	0.201	<b>0.801</b>		
TRU	0.618	0.001	0.109	0.261	0.146	0.084	-0.083	0.360	0.388	0.286	<b>0.786</b>	
ADOPT	0.69	-0.031	-0.050	0.136	0.201	0.348	0.329	0.295	0.174	0.283	0.289	<b>0.831</b>

Note: The colored diagonal elements are the square root of the variance shared between the constructs. Off diagonal elements are the correlations between constructs.

PLS Graph 3.0 was used to test the first eight hypotheses. Two main types of information obtained from PLS Graph 3.0 indicated how well the structural model predicted the hypothesized relationships. First, PLS Graph 3.0 provided the squared multiple correlation ( $R^2$ ) for each endogenous construct in the model. This number, which is similar to the  $R^2$  in the regression model, was used to measure the percentage of a construct's variation that the model explained (Wixom and Watson, 2001). The F test was used to assess the significance of  $R^2$  (Falk and Miller, 1992).

$$F = \frac{R^2 / m}{(1 - R^2) / (N - m - 1)}$$

Where N = the total number of the sample size, m = the number of items in the construct, F is distributed as an F distribution with m and (N-m-1) degrees of freedom.

In this study, all the exogenous factors in the model explained 27 percent of ASP adoption. Uncertainty and asset specificity explained 25.2 percent of variance of cost benefits. ASP's capability and social/personal relationship explained 19.6 percent of variance of trust. All  $R^2$  values were significant ( $P \leq 0.001$ ) by conducting the F test. The final results are shown in Table 5-9.

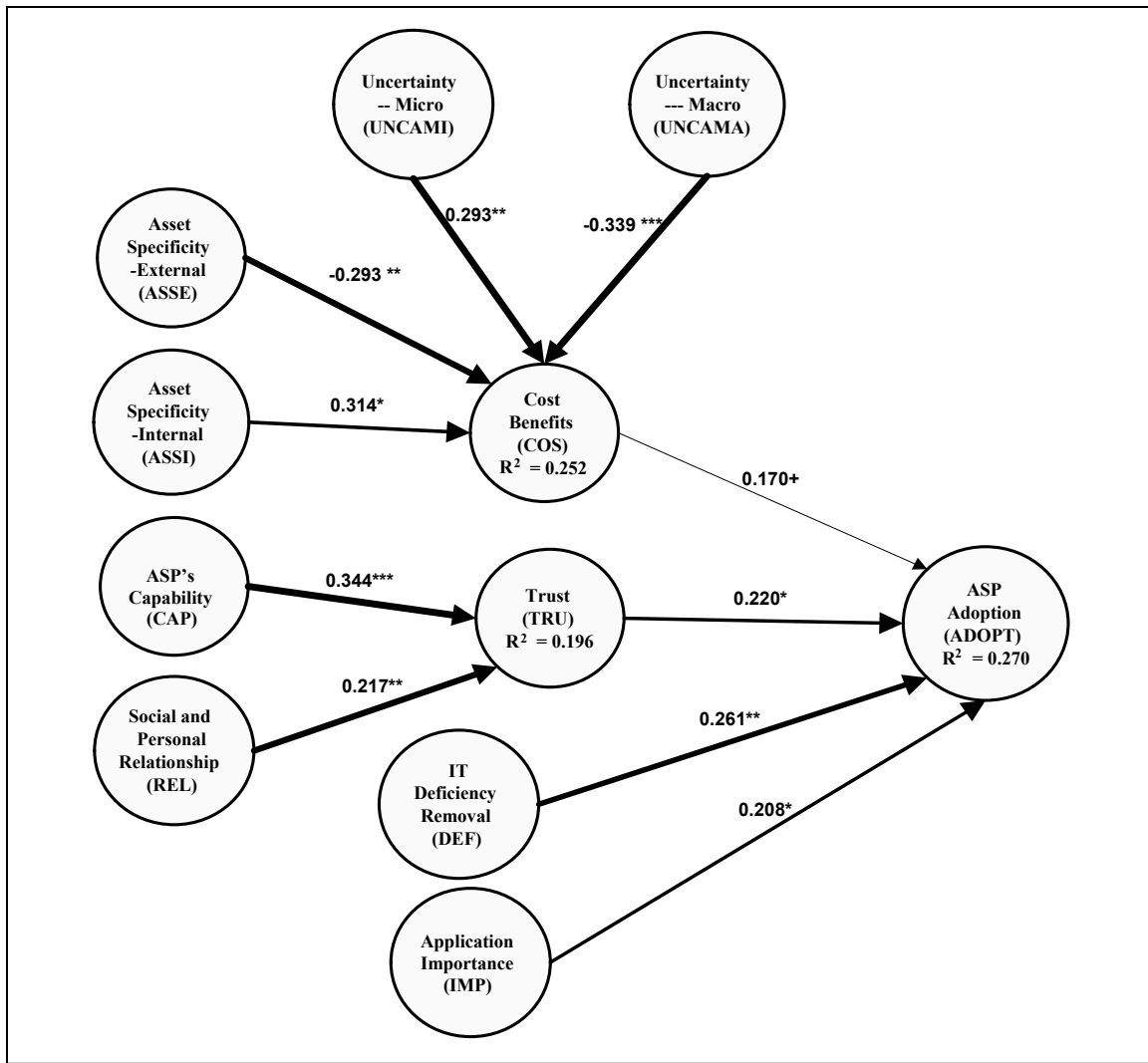
**Table 5-9 F-test for  $R^2$  in the model in survey one**

	$R^2$	F	P(F)
<b>COS</b>	0.252**	11.054	0.000
<b>TRU</b>	0.196**	3.751	0.001
<b>ADOPT</b>	0.27***	9.740	0.000

The second measure of the structural model provided by PLS Graph is path coefficients that indicate the strength of the relationship between the two constructs (Wixom and Watson, 2001). The bootstrap procedure with 200 resamples was used to calculate the significance of these coefficients. Figure 5-1 presents the structural path diagram with the coefficients of paths. All of the paths were statistically significant at the 0.05 level by a two-tailed test, except for the relationship between cost benefits and ASP adoption. This path was significant at the level of 0.10 in a one-tail t-test. As the direction of this relationship had already been established in the model, it was proper to use one-tail t-test to test path significance.

Two constructs representing uncertainty at both macro and micro levels had a significant relationship with cost benefits. Specifically, uncertainty at the micro level had a strong positive impact on the cost benefits ( $p < 0.001$ ). Respondents seemed to have the notion that high uncertainty associated with business operations of each company will increase cost benefits of ASP adoption. Moreover, uncertainty at the macro level had a negative impact on cost benefits. Respondents considered that macro environmental uncertainty will decrease the cost benefits of ASP adoption. Hence, H1 was partially supported in this data set.





\* indicate significant paths: \*\*\*  $P < 0.001$ , \*\*  $P < 0.01$ , \*  $P < 0.05$ , +  $P < 0.10$  (one-tail)

**Figure 5-1 ASP adoption decision model in survey one**

ASSE looked at the investment of ASPs on clients' operations. It had a strong negative impact on the cost benefits of ASP adoption ( $t = 2.41$ ,  $P < 0.01$ ). This result showed that high uniqueness of assets required to produce online applications will reduce cost benefits of ASP adoption. Internal asset specificity had a significant positive relationship with cost benefits of ASP adoption. These findings suggested that if an ASP can take care of the unique request of a client, the client's perception will be that cost benefits from ASP adoption are higher. According

to the definition of asset specificity assumed in this study, ASSE had a better representation for the construct of asset specificity. Thus, asset specificity had a strong negative relationship with Cost Benefits. Thus, H2 was supported in this data set.

The results showed that cost benefit had marginal impact on ASP adoption, as the path was just marginally significant. In the model, it was proposed that high cost benefits will increase ASP adoption. Hence, H3 was marginally supported.

Social and personal relationship also significantly impacted clients' trust on ASP ( $\lambda = 0.217$ ,  $P < 0.01$ ). This finding suggested that a closer relationship between the two companies and their managers will significantly increase the level of trust a client has towards an ASP. H4 was supported in this data set.

ASP's capability significantly impacted clients' perception of trust toward an ASP ( $\lambda = 0.344$ ,  $P < 0.001$ ). This was the strongest path in the entire model. These findings suggest that a high level of ASP capability will lead to a high level of trust towards the ASP. Hence, H5 was supported in this data set.

Trust had a relatively significant relationship with ASP adoption. The path loading was 0.220, and the p-value was less than 0.05. This finding suggested that a high level of client trust towards an ASP vendor will lead to a higher rate of ASP adoption, confirming that H6 was supported in the data set.

Internal IT deficiency removal significantly influenced ASP adoption. The path loading was 0.261, and p-value was less than 0.001. This finding supported hypothesis 7 that proposed as the ASP reduces the client's IT deficiency, the client is more willing to adopt the ASP. H7 therefore was supported by this data set.

Application importance had a significantly positive relationship with ASP adoption. The path loading was 0.208 and the p-value was less than 0.05. This result suggested that clients will more likely outsource their more important applications to an external ASP rather than outsource their non-core business functions. This contradicted the relationship proposed in hypothesis 8, showing that H8 was not supported in this data set.

After all of the main effects of all the factors on ASP adoption were assessed in the structural model, tests for the moderating effect of trust were conducted.

### **5.1.5 Moderating Relationship**

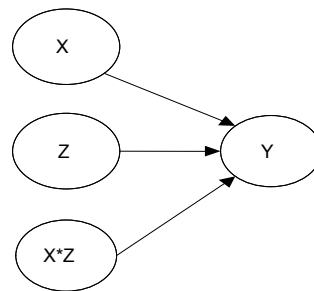
In addition to assessing the main effect of each factor, tests for the moderating effect of trust upon economic factors (cost benefits) and strategic factors (application importance and IT deficiency removal) were also conducted.

Generally, there are three possible ways to test a moderating relationship (Jöreskog, 1998). In the following part, these three approaches will be discussed respectively. In order to make the following discussion easier, some special terms, the exogenous variable, the endogenous variable and the interacting variable, are defined first. Assume there are two variables --- X and Y. X is the exogenous variable and Y is the endogenous variable. The relationship is:  $X \rightarrow Y$ . Variable Z, the interacting variable, moderates the relationship between X and Y. The issue here is to test the moderating effect of Z on the relationship between X and Y.

First, when moderating variable Z is observed and categorized (nominal or ordinal), the total sample can be divided into multiple groups, depending on the category of moderating variables (e.g., female and male, different age group). Interactions effects can be assessed by comparing path differences of the respective groups. This multi-group approach is the simplest and most straightforward, if the moderating variable can be used to form some “natural” groups (e.g. gender) (Jöreskog, 1998). But when the moderating variable Z is a latent construct, it is not easy to separate cases into different groups. If the cases are simply divided into two groups by the mean of Z, one group may lose some variance on X and Y, which can impact the analysis. Also, a large sample size is required for this approach, as each group needs enough cases to conduct a path test for X to Y.

Second, when the moderating variable Z is a latent variable, a product indicator can be used to test interactions (Chin, 1996, Schumacker, 2002). The multiplicative interaction effect  $X*Z$  is developed by multiplying values of all items measuring variable X with values of all

items measuring variable Z. After that, X, Y, Z and X\*Z are all specified in the structural equation modeling. The model is seen in Figure 5-2.



**Figure 5-2 Moderating relationship in approach two**

The interaction effect can be assessed by examining the path significance between X\*Z and Y. This method has proven to effectively assess the interaction effect (Chin, 1996). However, when X and Z both have more than seven measures, the interaction construct will have more than fifty items. In this case, three interaction constructs with a total of ninety-five items need to be created, making it difficult to specify a measurement model in PLS. Moreover, when the items become large (Jöreskog, 1998), the error terms will be undermined significantly, which will compromise the ability to perform an accurate data analysis.

Third, the latent variable score approach can also be used to assess a moderating relationship. The two-step procedure is addressed here (Bollen, 1995; Jöreskog, 1998). In the first step, for all cases, latent variable scores or factor scores are created that are used as indicators of the latent variables, X, Z, Y, specified in the model. In the second step, interaction variable X\*Z is created by multiplying the latent score of X and Z for each case. Then, the significance of path coefficient between interaction variable X\*Z and Y can show the moderating relationship. Schumacker (2002) applied the second and third methods on the same data set and compared the results. He found the results were almost the same. However, he recommended that “the latent variable score approach was easier to implement. The latent variable score approach also has utility when testing more complex structural equation interaction models” (p. 49). In most statistical software, latent variable scores can be easily generated, which further increases the convenience in using this approach.

In this study, the interactive variable “Trust” was not a categorical variable, but a latent variable. The sample size was relatively small, not large enough to be divided into two or more groups for further model testing. Moreover, the whole model was complex, with three moderating relationships. Each construct had five to seven indicators. Hence, by comparing these three methods, the latent variable score approach was more suitable in this study.

PLS Graph 3.0 generated latent variable scores for all the constructs. Three interaction constructs (TRU\*COS, TRU\*DEF, TRU\*IMP) were calculated by multiplying latent scores of TRU with COS, DEF and IMP, respectively. Then, a regression model was used to assess the three interaction effects individually and collectively in SPSS 11.5.

The moderating effect was assessed by path coefficients of the interaction variable in the regression model. If the interaction coefficient was significant, then there was a moderating effect (Bollen and Paxton, 1998). The beta coefficients of four interaction models are presented in Table 5-10.

In the table, the first three models tested three interactions independently to ensure that related interactions would not mask the effects of any interaction. As the direction of the moderating relationship had been specified in the established model, the one-tailed T-test was performed to test the significance of beta.

In the individual models, beta of TRU\*DEF was marginally significant. The beta was 0.159, very marginally significant at alpha level of 0.05. This result revealed that when the standard deviation is increased by 1, the influence of IT deficiency removal on ASP adoption will be increased from 0.261 to 0.420, which was proposed by Hypothesis 10b. The interaction effects of trust on cost benefits and application importance, respectively, were not significant. Hence, in this data set, respondents did not think that the effect of cost benefits and application importance on ASP adoption would be affected by clients’ trust.

Moreover, in the overall model including three interaction variables, the betas of the three interaction constructs were not significant at all. When the three interactions played together, trust had no significant interactions on the effect of cost benefits, IT deficiency removal, and application importance, upon ASP adoption. As all these three interactions were

**Table 5-10 Beta significance in four interaction models in survey one**

<b>Model</b>		<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>T</b>	<b>Sig.</b>
		<b>B</b>	<b>Std. Error</b>	<b>Beta</b>		
<b>TRU*COS</b>	COS	0.175	0.117	0.175	1.496	0.069
	IMP	0.184	0.106	0.184	1.739	0.043
	DEF	0.235	0.119	0.235	1.975	0.026
	TRU	0.224	0.105	0.224	2.134	0.018
	TRUCOS	0.114	0.106	0.108	1.074	0.143
<b>TRU*IMP</b>	COS	0.168	0.119	0.168	1.411	0.081
	IMP	0.213	0.113	0.213	1.888	0.031
	DEF	0.258	0.119	0.258	2.160	0.017
	TRU	0.220	0.106	0.220	2.066	0.021
	TRUIMP	0.012	0.101	0.013	0.122	0.452
<b>TRU*DEF</b>	COS	0.144	0.117	0.144	1.224	0.112
	IMP	0.168	0.106	0.168	1.588	0.058
	DEF	0.261	0.116	0.261	2.248	0.014
	TRU	0.246	0.105	0.246	2.341	0.011
	TRUDEF	0.145	0.092	0.159	1.582	0.059
<b>Full-Model</b>	COS	0.145	0.121	0.145	1.193	0.118
	IMP	0.171	0.116	0.171	1.481	0.071
	DEF	0.255	0.122	0.255	2.083	0.020
	TRU	0.243	0.108	0.243	2.258	0.013
	TRUDEF	0.136	0.119	0.148	1.147	0.128
	TRUCOS	0.017	0.136	0.016	0.125	0.450
	TRUIMP	0.010	0.101	0.010	0.095	0.462

proposed to exist in the same model simultaneously, whereby these interactions may impact each other to some extent, the path coefficients in the full model were more accurate and important to examine for interaction effects than results in the individual models. In this model, the insignificant beta coefficients of the three interaction constructs showed that the moderating impact of trust on cost benefits, application importance, and IT deficiency removal, respectively, are not important.

Overall, by examining three individual models and the full model together, the initial marginally supported interaction effect did not hold with confidence. In the full model, the beta of this interaction became insignificant. Hence, the three hypotheses of moderating interactions (H9, H10a and H10b) were not supported in this data set.

In addition to examining the beta significance of the interaction construct, the change of R2 between the interaction model and the main effect model was examined for effect size. The

significance of the R<sup>2</sup> change also indicated the contribution of interaction variables to the explanation of variance. Moreover, Cohen's f<sup>2</sup> (1988) was used for effect size testing. According to Cohen, when f<sup>2</sup> is larger than 0.02 (small size sample), the interaction effect can be considered as a moderating effect.

$$f^2 = \frac{R_{interaction}^2 - R_{main\ effect}^2}{1 - R_{interaction}^2}$$

The R<sup>2</sup> changes between the interaction models and main effect model were calculated in SPSS 11.5. The interaction models included three individual models and the full model. The final results and effect size of interactions are presented in Table 5-11.

**Table 5-11 R<sup>2</sup> changes between interaction models and main effect model in survey one**

Model	R Square	Std. Error	R Square Change	F Change	Sig. F Change	f <sup>2</sup>
<b>Main Effect</b>	0.270	0.882				
<b>TRU*COS</b>	0.280	0.881	0.011	1.153	0.286	0.015
<b>TRU*IMP</b>	0.270	0.887	0.000	0.015	0.903	0.000
<b>TRU*DEF</b>	0.293	0.873	0.023	2.502	0.118	0.032
<b>Full Model</b>	0.293	0.885	0.023	0.821	0.486	0.033

The interaction effect of trust on deficiency was at the lower moderate level (f<sup>2</sup> = 0.032). The interaction of trust on cost was relatively small (f<sup>2</sup> = 0.015). There was no effective interaction of trust on application importance (f<sup>2</sup> = 0.000). Even in the full model, the effect size was 0.033, which is considered a moderate effect.

Chin, et al., (1998) conducted interaction tests in different effect sizes and sample sizes. They found that “[With moderate effect], it is clearest for the interaction effect where a significant effect at the 0.01 level was obtained at a larger sample size of 150 with four to six indicators or at a smaller size of 100 with eight indicators.” In this study, the sample size was small, and the effect size was at a small and moderate level. Hence, it is understandable that the interaction effects of trust upon the three variables, cost benefits, application importance, and IT deficiency removal were not significant.

Furthermore, in the tests for the interaction effect of trust upon IT deficiency removal, the interaction variable contributed a 2.3 percent explanation of variance. The P-value result from the F-test was very marginally significant at the alpha level of 0.1. The marginal significance of this path coefficient may indicate some potential for the existence of this interaction effect, but it does not support the proposed hypothesis of the interaction impact of trust on cost benefits. In addition, there were no significant increases on  $R^2$  in either of the other two individual models or the full model. The results further confirmed that there were no significant interaction effects of trust in this data set.

When all the path coefficients and  $R^2$  changes were taken into consideration, it was further determined that these results did not support the three interaction effects. The results obtained from hypotheses testing are summarized in Table 5-12.

## **5.2 Survey Two – Top Computer Executives**

The second survey was conducted among top computer executives of companies throughout the United States. The exact data analysis procedure adopted in survey one was followed to analyze the second data set.

### **5.2.1 Survey Response**

In this section, survey response rate, missing data analysis, and non-response bias assessment are discussed.

#### **5.2.1.1 Survey Response Rate and Missing Value Analysis**

The sampling frame for this study is top computer executives (TCE) of companies throughout the United States. The survey questionnaires were distributed to randomly selected TCEs from a public list. In this sample, many companies changed mailing addresses, telephone numbers or even had gone out of business. Moreover, some TCEs had already left the companies selected. As a result, these cases were excluded, and the total effective sample size was 782.

Eighty-seven questionnaires were returned. This yielded an effective response rate of 11 percent. Among these 87 responses, seven respondents indicated that they were current ASP



**Table 5-12 Summary of results in survey one**

Number	Hypothesis	Results
H1	A higher level of environmental uncertainty will lead to greater cost benefits associated with ASP adoption.	Partially Supported
H2	A higher level of asset specificity will lead to less cost benefits associated with ASP adoption.	Supported
H3	Perceived higher cost benefits associated with ASP adoption lead to a higher degree of ASP adoption.	Marginally Supported
H4	A closer social and personal relationship between managers of an ASP and their client will lead to higher levels of trust in the ASP.	Supported
H5	A perceived higher level of ASP capability will lead to a higher level of trust in the ASP.	Supported
H6	A higher level of trust between the ASP and the ASP client will result in a higher degree of ASP adoption.	Supported
H7	As the perceived ability of an ASP to eliminate a client's IT deficiency increases, the degree of ASP adoption increases.	Supported
H8	A higher level of application importance will result in a lower degree of ASP adoption.	Not Supported
H9	Trust will moderate the relationship between cost benefits and the degree of ASP adoption such that when trust is high, there is a less positive relationship between cost benefits and the degree of ASP adoption than when trust is low.	Not Supported
H10a	Trust will moderate the relationship between application importance and the degree of ASP adoption such that when trust is high, there is a less negative relationship between application importance and the degree of ASP adoption than when trust is low.	Not supported
H10b	Trust will moderate the relationship between IT deficiency removal and the degree of ASP adoption such that when trust is high, there is a more positive relationship between IT deficiency removal and the degree of ASP adoption than when trust is low.	Not supported

\* Macro-uncertainty is supported to positively impact cost benefits; micro-uncertainty is not supported to positively impact cost benefits.

clients and 80 respondents indicated that they were clients who were not using ASP applications. As the sample of current ASP clients had too few cases to conduct any effective data analysis, the survey analysis focused on non-current ASP clients.

Missing data analysis was performed, and there were no systematic missing values encountered in this data set. Among the remaining data, 20 cases had a missing value of less than 2 percent on items measuring constructs. These cases were retained because they will not impact the overall results. As PLS analysis usually works better on a data set with no missing values, the mean substitution solution was adopted in this data set to handle missing values.

Moreover, among eight demographic variables, there were no variables with missing values more than 2 percent except gross revenue, which had four missing values (5 percent). These demographic values were retained without any change.

Thus, in the second survey, the final usable sample size was 80.

#### **5.2.1.2 Non-Response Bias Assessment**

Similar to the survey, the extrapolation method was adopted to predict non-response bias (Hartman, et al., 1989; Churchill, 1991). The responses of earlier respondents and late respondents were compared to assess the differences.

In this study, September 30<sup>th</sup> was defined as the cutoff point to distinguish early respondents from late respondents. This was also the date that the telephone reminder effort was initiated. Forty-four out of 80 of the respondents (55 percent) were classified as early respondents, while 36 out of 80 of the respondents (45 percent) were classified as late respondents.

In order to ensure that early respondents and late respondents did not differ systematically, these two groups of respondents were compared based on demographic data, including position of respondent, number of employees, number of IT professionals, previous outsourcing experiences, in-house maintenance experiences, industry, and size of city. The mean of each question was compared by using independent sample t-tests in SPSS 11.5. Upon assessing Levene's test for equal variance, no significant variance differences existed for all the demographic variables ( $p < 0.05$ ). Thus, in this study, equal error variances were assumed for all the variables.

No significant demographic differences were found between the early respondents and late respondents at the alpha level of 0.05. Therefore, based on the assessment results (See Table 5-13), there was no significant response bias in this study.

In addition, as the tracking numbers were hard coded in the return envelope and most participants filled in the questionnaires on the website, these participants can not be identified. It

is impossible to conduct further examination on demographic differences between respondents and non-respondents.

**Table 5-13 Non-response bias assessment in survey two: early respondents vs. late respondents**

	N	Mean	Std. Deviation	t-value	Df	Sig. (2-tailed)
<b>Position</b>						
Early respondents	44	2.023	0.976	0.618	78	0.539
Late Respondents	36	1.889	0.950			
<b>Num. Employees</b>						
Early respondents	44	3.114	1.083	1.105	78	0.273
Late Respondents	36	2.833	1.183			
<b>Num. IT professionals</b>						
Early respondents	44	2.091	1.178	-1.310	78	0.194
Late Respondents	36	2.444	1.229			
<b>Gross revenue</b>						
Early respondents	42	4.571	2.349	0.477	74	0.635
Late Respondents	34	4.294	2.714			
<b>Outsource experience</b>						
Early respondents	42	0.500	0.506	0.000	76	1.000
Late Respondents	36	0.500	0.507			
<b>In-house main. Experience</b>						
Early respondents	44	0.364	0.487	0.725	77	0.470
Late Respondents	35	0.286	0.458			
<b>Industry</b>						
Early respondents	44	6.477	4.767	-1.606	78	0.112
Late Respondents	35	8.194	4.744			
<b>City size</b>						
Early respondents	44	4.864	1.786	0.006	78	0.995
Late Respondents	36	4.861	1.988			

However, an attempt was made to understand the cause of non-response. During the reminder phone calls, several reasons of delay in participation and refusal were identified. Roughly 12.5 percent of non-respondents at that time said that they either did not receive the mail-outs or did not open the mail. Another 12 percent said that they did not find the time to take the survey, but they might do it later. Of non-respondents, 16.3 percent refused to participate due to companies' policy regarding survey research. In addition, about 9 percent of non-respondents expressed that because they were not aware of the ASP business model, they could not provide valuable feedback. It was reasonable to exclude these participants from the sample, as they were not qualified subjects. The remaining non-respondents were not reached personally after several attempts and only voice messages were left.

Hence, based on the available information, there were no indications to show any significant non-respondents' biases.

### **5.2.2 Descriptive Analysis**

The participants were randomly selected from a public list. This sample consisted of 38 percent executive IT managers, 7 percent functional managers and 35 percent IT managers.

All of the respondents were considered to be upper management at their respective organizations.

In this sample, 38 organizations (47.5 percent) were large companies having more than 500 employees, 15 organizations (18.75 percent) were medium companies (number of employees was within a range of 100 to 500), and 27 organizations (33.75 percent) were small (number of employees was less than 100). This sample thus consisted of a nearly equal number of large companies and small or medium enterprise (SMEs).

The number of IT professionals in each organization varied. About 31 organizations (38.75 percent) had less than 10 IT professionals employed, 30 companies (37.5 percent) had between 11 and 50 IT professionals employed, and 19 organizations (23.75 percent) had more than 50 IT professionals employed.

In this sample, there were 39 companies (49 percent) having previous information systems outsourcing experience of some kind while 39 companies (49 percent) had no outsourcing experience. About 53 organizations (66 percent) had never maintained the systems that they might consider outsourcing. The remaining 27 organizations were currently maintaining the systems that they would consider for outsourcing. Hence, in this data set, there were relatively balanced cases to represent companies in the different categories of these demographic variables.

The gross revenue of organizations was almost equally distributed across all categories, from less than \$5 million to more than \$1 billion. The medium number ranged between \$10 million to \$20 million.

In this sample, all of the industries were represented with multiple companies. Among 80 companies, about 22 (27.5 percent) were from the manufacturing industry and 14 companies (17.5 percent) were high-tech companies. The remaining companies were equally distributed across all other industries, as illustrated in Table 5-14.

The size of cities was also equally distributed among all the categories, from small cities with less than 50,000 residents, to very large cities with more than 1 million residents. Only one company was an exception, which was located in a very small town with only 10,000 residents. The medium number of city size fell into the category of 250,000 to 499,999 residents.

Table 5-14 summarizes all the sample characteristics. From the demographic variables, this data set covered all the categories with relatively equal distribution and showed a certain representation.

### **5.2.3 Measurement Model and Validity and Reliability Testing**

Similar to the first data set, a two-step model testing was adopted with the second data set. In this section, the steps that were conducted to ensure the validity and reliability of the instruments are discussed. First, the normal distribution and outliers are discussed. Second, the measurement model (outer model) in PLS is presented, followed by a discussion of reliability and discriminant validity testing.

#### **5.2.3.1 Assessment of Normal Distribution and Outliers**

Similar to the analysis in the first data set, the normality of all nonparametric variables was assessed by plotting histograms and normal probability plots. In addition, Kolmogorov-Smirnov goodness-of-fit test was conducted in SPSS 11.5.

The results indicated that the normal distribution was held for most variables in this study. Specifically, fifty-two out of seventy-nine variables used to measure constructs were tested to be normally distributed. Though PLS can handle non-normal distribution issues, this normal distribution data set can enhance the statistical analysis.

**Table 5-14 Responses to categorical demographic questions in survey two**

	<b>Category</b>	<b>Number</b>	<b>Percent</b>
<b>Positions</b>	Executive manager	38	47.5
	Functional manager	7	8.75
	IS/IT manager	35	43.75
<b>No. of Employees</b>	Less than 20	12	15
	20-99	15	18.75
	100-500	15	18.75
	More than 500	38	47.5
<b>No. of IT Professionals</b>	Less than 10	31	38.75
	11-30	17	21.25
	31-50	13	16.25
	More than 50	19	23.75
<b>Outsourcing Experience</b>	No	39	48.75
	Yes	39	48.75
	not report	2	2.5
<b>In-house Maintenance Experience</b>	No	53	66.25
	Yes	26	32.5
<b>Gross Revenue</b>	not report	1	1.25
	Less than \$5 million	17	21.25
	\$5 million --- \$10 million	5	6.25
	\$10.1 million --- \$20 million	7	8.75
	\$20.1 million --- \$50 million	6	7.5
	\$50.1 million --- \$100 million	10	12.5
	\$100.1 million --- \$500 million	12	15
	\$500.1 million --- \$1 billion	8	10
	more than \$1 billion	11	13.75
	not report	4	5
<b>Industry</b>	Aerospace and Defense	1	1.25
	Banking/Finance/Accounting	8	10
	Manufacture	22	27.5
	Healthcare/Medical	2	2.5
	Insurance	1	1.25
	Real estate/Legal	5	6.25
	Government(Fed, State, Local)	4	5
	High Tech	14	17.5
	Education	3	3.75
	Research/Develop Lab	1	1.25
	Communications	3	3.75
	Energy	1	1.25
	Business Service/Consultant	1	1.25
	Publishing/Public Relation	4	5
	Wholesale/Retails/Distribution	3	3.75
	Transportation/Utility	1	1.25
	Marketing/Advertising/Entertainment	6	7.5

(Table 5-14 cont.)

	<b>Category</b>	<b>Number</b>	<b>Percent</b>
<b>City Size</b>	10,000 --- 49,999	13	16.25
	50,000 --- 99,999	9	11.25
	100,000 --- 249,999	8	10
	250,000 --- 499,999	12	15
	500,000 --- 999,999	16	20
	1,000,000 or more	21	26.25
<b>Total</b>		<b>80</b>	<b>100.00</b>

Moreover, as the Likert scale was used to measure all the measurements, outliers are not a concern. It was reasonable to have responses at every scale level.

### **5.2.3.2 Assessment of the Measurement (outer) Model**

Similar to the analysis in the first data set, in order to assess reliability and discriminant validity, the measurement model was evaluated in PLS Graph 3.0.

#### **5.2.3.2.1 Factor Analysis**

Similar to the analysis in the first data set, factor analysis is conducted to identify the total number of factors and the extent to which factors can be explained by each variable.

The statement of questions used for non-ASP clients was similar to that for current ASP clients, though contexts were different. Hence, the same items used to measure exogenous variables (independent variables) in the data set of current ASP clients were supposed to work well on the measurement model for the non-ASP clients. Only the endogenous construct (dependent variable) was different in the two questionnaires.

In order to make sure all the constructs worked well, all the items were still put into EFA. According to the rules for item checking, after iterative assessment, eight items were removed from the measurement process. They were almost the same as the ones removed in the first survey, except that “Technology change” (UNCA6) and “Save hardware cost” (COS1) were not removed. The exact items and reasons for dropping them are listed in Table 5-15.

**Table 5-15 Items dropped during exploratory factor analysis in survey two**

<b>Construct</b>	<b>Dropped Items</b>	<b>Reason</b>
Uncertainty	Government police (UNCA2)	low MSA value (0.365)
Cost Benefits	Save switch cost (COS9)	Low loading (0.438)
ASP Adoption	Adoption way (ADPWAY)	Low MSA value (0.265)
Relationship	ASP managers known to us (REL1)	Low MSA value (0.385)
	ASP known to us (REL2)	Low MSA value (0.328)
Capability	Partnering with other vendors (CAP10)	Low MSA value (0.395)
Importance	Impact customers (CUSINT)	Low MSA value (0.389)
Trust	Provide highly reliable service (TRU6)	Low MSA value (0.418)

After this iterative removal process, fifty-eight items were kept for further data analysis. All items loaded separately on the constructs that they were supposed to measure. The loadings were considerably high. There were no significant double-loading problems. Moreover, Cronbach's Alpha was calculated for each construct to assess reliability. All constructs had an alpha higher than 0.8. Hence, by checking reliability and factor loadings, the initial construct validity and discriminant validity were approved for this instrument. The factor loadings of all the items and the Cronbach's Alpha are reported in Table 5-16.

#### **5.2.3.2.2 Measurement Model**

After analyzing the dimensionality of all the measurements in EFA, the measurement model was performed in PLS Graph 3.0 to further assess the reliability and construct validity of the instrument. As discussed in the previous section, the measurement model employed confirmatory factor analysis to validate established dimensionality of scales and to disclose measurement problems. Weights and loadings were generated in PLS Graph 3.0 for each item specified to measure a certain construct.

In this study, the initial weight and loadings were assessed and one item (cos1) was further removed from the initial measurement due to low loadings. Similarly, UNCA is divided into two sub-constructs, UNCAMI and UNCAMA. These two constructs measure micro and macro environmental uncertainty, respectively.

Even though wording differences among the two questionnaires existed, the domain contents of the constructs were the same. The statements of the questions were exactly the same, and only the contexts (stated as the leading sentence for each group of questions) were different.



**Table 5-16 Loadings in exploratory factor analysis and Cronbach's alpha in survey two**

	UNCA	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT	Alpha
UNCA1	<b>0.873</b>	0.079	-0.057	0.038	-0.023	-0.031	0.029	0.054	-0.134	-0.027	0.93
UNCA3	<b>0.738</b>	-0.105	-0.043	0.251	0.075	-0.081	0.250	0.237	0.010	0.184	
UNCA4	<b>0.726</b>	-0.068	0.043	0.233	0.085	-0.155	0.153	0.288	-0.016	0.140	
UNCA5	<b>0.898</b>	-0.079	0.045	0.012	0.167	-0.059	-0.048	0.109	-0.040	0.024	
UNCA6	<b>0.783</b>	-0.049	0.057	0.288	0.134	-0.025	0.157	0.263	-0.004	0.035	
UNCA7	<b>0.870</b>	-0.053	0.052	-0.038	0.046	-0.037	0.022	-0.074	0.145	-0.018	
UNCA8	<b>0.820</b>	-0.032	0.078	-0.136	0.075	-0.153	-0.039	-0.023	0.187	0.085	
ASS1	0.015	<b>0.809</b>	0.102	-0.171	-0.257	-0.005	-0.077	-0.052	-0.030	-0.209	0.91
ASS2	-0.160	<b>0.830</b>	0.011	-0.248	-0.104	-0.048	-0.030	0.098	0.071	-0.066	
ASS3	0.012	<b>0.851</b>	0.050	-0.164	-0.229	0.058	-0.106	0.025	-0.030	-0.003	
ASS4	-0.084	<b>0.860</b>	-0.030	-0.210	-0.128	0.027	-0.048	-0.016	-0.001	-0.089	
ASS5	0.012	-0.021	<b>0.842</b>	0.128	-0.025	-0.100	-0.069	-0.040	0.071	-0.094	0.91
ASS6	0.012	0.075	<b>0.889</b>	0.139	0.053	-0.005	0.021	-0.052	-0.006	0.050	
ASS7	0.054	0.048	<b>0.876</b>	0.155	-0.005	-0.088	-0.132	-0.039	0.033	0.007	
ASS8	0.056	0.008	<b>0.881</b>	0.092	0.020	0.106	-0.046	-0.090	0.017	0.104	
COS1	0.054	-0.091	0.140	<b>0.527</b>	0.070	-0.107	0.408	-0.111	-0.057	-0.237	0.9
COS2	0.179	-0.060	-0.020	<b>0.699</b>	0.245	-0.007	0.053	-0.072	0.262	0.061	
COS3	0.030	-0.149	0.096	<b>0.698</b>	0.162	0.184	0.142	0.122	-0.100	0.194	
COS4	0.094	-0.177	0.120	<b>0.713</b>	0.035	0.113	0.161	0.029	0.163	0.186	
COS5	0.105	-0.191	-0.048	<b>0.807</b>	0.177	0.085	0.126	-0.042	-0.014	0.094	
COS6	0.013	-0.090	0.277	<b>0.731</b>	0.206	0.095	0.015	0.136	0.024	0.241	
COS7	0.045	-0.102	0.213	<b>0.765</b>	0.159	-0.043	-0.013	0.098	-0.019	0.123	
COS8	-0.034	-0.170	0.087	<b>0.738</b>	0.235	0.085	0.015	0.035	0.115	0.230	
DEF1	0.172	-0.181	-0.046	0.238	<b>0.756</b>	-0.110	0.130	0.043	0.060	0.131	0.94
DEF2	-0.037	-0.104	-0.002	0.235	<b>0.766</b>	-0.084	0.226	0.084	-0.017	0.237	
DEF3	0.027	-0.246	0.061	0.269	<b>0.706</b>	-0.035	0.232	0.199	0.063	0.237	
DEF4	0.112	-0.182	-0.074	0.044	<b>0.787</b>	0.069	0.272	-0.012	0.022	0.066	
DEF5	0.109	-0.097	0.053	0.123	<b>0.840</b>	0.063	0.084	0.046	-0.020	0.265	
DEF6	0.091	-0.015	0.097	0.217	<b>0.856</b>	0.067	0.096	-0.012	0.135	0.060	
DEF7	0.077	-0.105	0.000	0.134	<b>0.823</b>	0.035	0.009	0.086	0.045	0.184	

(Table 5-16 cont.)

	UNCA	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT	Alpha
IMP1	-0.123	0.025	-0.002	0.093	0.041	<b>0.903</b>	0.034	-0.020	0.065	-0.042	0.92
IMP2	-0.077	0.012	-0.046	-0.046	-0.021	<b>0.848</b>	-0.084	-0.100	-0.095	-0.014	
IMP3	-0.060	-0.024	-0.085	0.129	-0.023	<b>0.842</b>	0.130	-0.055	-0.194	-0.046	
IMP4	-0.038	0.037	0.049	0.023	0.056	<b>0.868</b>	-0.014	0.038	0.073	-0.011	
IMP5	-0.111	-0.024	-0.015	0.111	-0.020	<b>0.857</b>	-0.034	0.088	-0.124	-0.056	
CAP1	0.133	-0.043	-0.097	0.029	0.104	-0.166	<b>0.745</b>	0.149	0.044	0.108	0.94
CAP2	-0.002	-0.004	-0.038	0.017	0.134	-0.009	<b>0.764</b>	0.159	0.191	0.188	
CAP3	0.108	-0.032	-0.040	-0.077	0.080	-0.009	<b>0.865</b>	0.058	0.005	0.068	
CAP4	0.019	-0.036	-0.051	0.122	0.225	-0.012	<b>0.753</b>	0.153	0.238	0.279	
CAP5	-0.051	-0.054	-0.048	0.227	0.118	0.058	<b>0.870</b>	-0.046	0.102	0.112	
CAP6	0.046	0.085	-0.153	0.064	0.060	0.107	<b>0.770</b>	-0.150	0.211	0.303	
CAP7	0.001	-0.028	-0.017	0.120	0.107	0.014	<b>0.832</b>	-0.029	0.033	-0.013	
CAP8	0.119	-0.190	0.028	0.219	0.073	0.047	<b>0.748</b>	0.099	0.256	0.176	
CAP9	0.058	-0.062	0.062	0.010	0.096	0.048	<b>0.811</b>	0.055	0.263	0.105	
REL3	0.155	0.065	-0.073	0.098	0.268	-0.061	0.146	<b>0.792</b>	0.247	0.154	0.88
REL4	0.266	-0.031	-0.037	0.113	0.035	-0.102	0.123	<b>0.781</b>	0.173	0.170	
REL5	0.259	0.057	-0.196	-0.052	0.036	0.127	0.048	<b>0.775</b>	0.229	0.131	
TRU1	-0.008	0.026	0.209	0.082	0.015	-0.051	0.163	0.079	<b>0.793</b>	0.109	0.88
TRU2	0.011	-0.142	-0.009	0.014	0.025	-0.103	0.276	0.055	<b>0.774</b>	0.175	
TRU3	0.003	0.144	-0.026	0.225	0.075	-0.071	0.264	0.156	<b>0.676</b>	0.074	
TRU4	0.022	-0.028	0.072	-0.072	0.128	0.006	0.316	0.176	<b>0.724</b>	0.141	
TRU5	0.076	0.017	-0.085	0.049	0.006	-0.065	0.067	0.111	<b>0.832</b>	0.051	
ADPGEN	0.059	-0.088	0.115	0.299	0.249	-0.128	0.279	-0.031	0.253	<b>0.728</b>	0.83
ADPMOST	0.174	-0.030	0.047	0.213	0.230	-0.044	0.289	0.083	0.177	<b>0.747</b>	
ADPTIME	0.214	-0.088	0.146	0.263	0.159	-0.040	0.290	-0.020	0.206	<b>0.671</b>	
APPTOTAL	0.133	-0.194	-0.029	0.275	0.283	-0.090	0.253	0.085	0.162	<b>0.680</b>	
ADPPERC	-0.008	-0.088	-0.087	0.094	0.249	-0.065	0.232	0.205	0.122	<b>0.760</b>	
ADPBUDG	-0.052	-0.088	-0.007	0.140	0.298	0.036	0.096	0.303	-0.040	<b>0.702</b>	

Hence, the items used to measure the construct in the first questionnaire should represent the domain value of the specified constructs. These two questionnaires only represented the different context, not the statements. For the purpose of comparison, the two models should use the same measurement items, so in the second survey, only the items used in the first study remained for further data analysis.

The initial and final loadings and weights of each item on its specified construct are presented in Table 5-17.

**Table 5-17 Loadings and weights of measurement model and composite reliability in survey two**

Construct	Variable	Original Model		Refined Model		
		Weight	Loading	Weight	Loading	Composite reliability
<b>Uncertainty-MA (UNCAMA)</b>	UNCA1	0.2664	0.8933	0.2339	0.8836	0.938
	UNCA5	0.5212	0.9617	0.5189	0.9632	
	UNCA7	0.2959	0.895	0.2999	0.9	
	UNCA8	-0.0052	0.79	0.0293	0.8053	
<b>Uncertainty-MI (UNCAMI)</b>	UNCA3	0.3518	0.9474	0.5323	0.9684	0.966
	UNCA4	0.3264	0.9458	0.5023	0.9644	
	UNCA6	0.3816	0.9382	Removed		
<b>Asset Specificity -External (ASSE)</b>	ASS1	0.2848	0.8886	0.2909	0.89	0.94
	ASS2	0.3015	0.886	0.3022	0.8862	
	ASS3	0.2472	0.8939	0.2389	0.8918	
	ASS4	0.2879	0.8988	0.2895	0.899	
<b>Asset Specificity -Internal (ASSI)</b>	ASS5	0.2357	0.8552	0.2322	0.8543	0.939
	ASS6	0.3155	0.9077	0.3097	0.9067	
	ASS7	0.2847	0.9029	0.287	0.9032	
	ASS8	0.2837	0.8989	0.2905	0.9004	
<b>Cost Benefits (COS)</b>	COS1	0.0979	0.51	Removed		0.932
	COS2	0.1596	0.7329	0.1658	0.7332	
	COS3	0.1612	0.797	0.1705	0.7973	
	COS4	0.1815	0.8026	0.1892	0.8055	
	COS5	0.1684	0.8409	0.1745	0.8359	
	COS6	0.1758	0.847	0.1859	0.856	
	COS7	0.1475	0.8212	0.1576	0.823	
	COS8	0.1783	0.8262	0.1855	0.838	
<b>Deficiency Removal (DEF)</b>	DEF1	0.1619	0.8547	0.1619	0.8547	0.965
	DEF2	0.1898	0.8749	0.1897	0.8749	
	DEF3	0.1964	0.8742	0.1964	0.8742	
	DEF4	0.1365	0.8201	0.1365	0.8201	
	DEF5	0.1797	0.8908	0.1797	0.8908	
	DEF6	0.1398	0.8651	0.1398	0.8651	
	DEF7	0.1556	0.8414	0.1557	0.8414	
<b>Importance (IMP)</b>	IMP1	0.1668	0.8927	0.167	0.8927	0.939
	IMP2	0.3766	0.9012	0.3767	0.9012	
	IMP3	0.2403	0.857	0.2403	0.857	
	IMP4	0.0668	0.7998	0.0667	0.7998	
	IMP5	0.2828	0.8924	0.2826	0.8923	

(Table 5-17 cont.)

Construct	Variable	Original Model		Refined Model		
		Weight	Loading	Weight	Loading	Composite reliability
Capability (CAP)	CAP1	0.1142	0.7683	0.1438	0.788	0.95
	CAP2	0.1483	0.8399	0.1867	0.8655	
	CAP3	0.0941	0.8224	0.1185	0.8333	
	CAP4	0.1644	0.8868	0.2069	0.897	
	CAP5	0.1174	0.8918	0.1478	0.8754	
	CAP6	0.1355	0.8397	0.1706	0.848	
	CAP7	0.0936	0.7936	Removed		
	CAP8	0.1623	0.8537	Removed		
	CAP9	0.152	0.8761	0.1914	0.8707	
Relationship (REL)	REL3	0.4259	0.9275	0.4258	0.9275	0.928
	REL4	0.3448	0.8881	0.3446	0.8881	
	REL5	0.3378	0.8845	0.338	0.8846	
Trust (TRU)	TRU1	0.2163	0.8363	0.2148	0.8357	0.914
	TRU2	0.2631	0.8541	0.2646	0.8548	
	TRU3	0.259	0.7891	0.2571	0.788	
	TRU4	0.281	0.8517	0.2824	0.8523	
	TRU5	0.1917	0.7865	0.192	0.7867	
Adoption (ADOPT)	ADPPERC	0.1768	0.8444	0.1771	0.8448	0.944
	ADPBUDG	0.1564	0.7563	0.1572	0.7568	
	APPTOTAL	0.2138	0.8788	0.2142	0.879	
	ADPGEN	0.2215	0.9188	0.2214	0.9186	
	ADOPMOST	0.1972	0.9067	0.1968	0.9064	
	ADPTIME	0.1922	0.8445	0.1912	0.844	

### 5.2.3.3 Assessment of Reliability

In the Table 5-17, all the indicators had loadings higher than 0.7, and therefore, all of the measurements met the requirements for reliability prescribed by Chin (1998). This measurement model proved that the instrument was adequate in measuring each construct individually.

Moreover, as another indicator, internal composite reliability (ICR) provides a good assessment of measurement reliability. In the measurement model, composite reliability for each construct was higher than 0.9 (see Table 5-18). This result provided strong evidence that the instrument was reliable.

**Table 5-18 Cross-loading assessment for survey two**

	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
UNCA1	<b>0.884</b>	0.629	-0.001	-0.015	0.064	0.042	-0.093	0.049	0.236	-0.069	0.050
UNCA3	0.654	<b>0.968</b>	-0.251	0.003	0.342	0.312	-0.119	0.329	0.435	0.214	0.439
UNCA4	0.637	<b>0.964</b>	-0.200	0.084	0.323	0.285	-0.214	0.234	0.444	0.164	0.369
UNCA5	<b>0.963</b>	0.667	-0.162	0.072	0.141	0.242	-0.154	0.022	0.321	0.010	0.170
UNCA7	<b>0.900</b>	0.531	-0.102	0.073	0.082	0.121	-0.145	0.100	0.216	0.130	0.112
UNCA8	<b>0.805</b>	0.537	-0.063	0.087	0.008	0.129	-0.277	0.071	0.234	0.178	0.166
ASS1	-0.053	-0.182	<b>0.890</b>	0.093	-0.390	-0.451	-0.009	-0.202	-0.131	-0.104	-0.398
ASS2	-0.187	-0.217	<b>0.886</b>	-0.013	-0.406	-0.303	-0.042	-0.085	0.018	0.045	-0.240
ASS3	-0.032	-0.170	<b>0.892</b>	0.060	-0.321	-0.388	0.039	-0.160	-0.012	-0.085	-0.256
ASS4	-0.128	-0.258	<b>0.899</b>	-0.031	-0.389	-0.337	0.025	-0.122	-0.029	-0.064	-0.286
ASS5	0.008	0.037	0.009	<b>0.854</b>	0.185	-0.005	-0.124	-0.113	-0.125	0.059	-0.007
ASS6	0.049	0.036	0.046	<b>0.907</b>	0.247	0.096	-0.040	-0.021	-0.112	0.065	0.114
ASS7	0.075	0.043	0.047	<b>0.903</b>	0.229	0.012	-0.113	-0.149	-0.098	0.030	0.056
ASS8	0.068	0.039	-0.005	<b>0.900</b>	0.232	0.063	0.067	-0.049	-0.142	0.043	0.115
COS2	0.159	0.390	-0.302	0.121	<b>0.733</b>	0.420	-0.018	0.210	0.155	0.299	0.382
COS3	0.071	0.252	-0.347	0.174	<b>0.797</b>	0.397	0.193	0.228	0.178	0.068	0.416
COS4	0.075	0.342	-0.354	0.219	<b>0.805</b>	0.323	0.101	0.301	0.165	0.262	0.424
COS5	0.112	0.327	-0.417	0.077	<b>0.836</b>	0.408	0.115	0.223	0.095	0.081	0.398
COS6	0.088	0.235	-0.300	0.352	<b>0.856</b>	0.424	0.104	0.161	0.197	0.151	0.463
COS7	0.134	0.226	-0.308	0.297	<b>0.823</b>	0.349	-0.016	0.099	0.145	0.092	0.358
COS8	0.017	0.194	-0.388	0.193	<b>0.838</b>	0.450	0.105	0.197	0.154	0.187	0.481
DEF1	0.224	0.365	-0.403	0.001	0.442	<b>0.855</b>	-0.111	0.303	0.262	0.187	0.477
DEF2	0.040	0.260	-0.332	0.024	0.444	<b>0.875</b>	-0.063	0.374	0.259	0.154	0.559
DEF3	0.113	0.315	-0.457	0.079	0.534	<b>0.874</b>	-0.051	0.425	0.339	0.248	0.578
DEF4	0.191	0.220	-0.365	-0.065	0.296	<b>0.820</b>	0.027	0.379	0.194	0.158	0.402
DEF5	0.193	0.261	-0.330	0.085	0.385	<b>0.891</b>	0.036	0.266	0.225	0.129	0.529
DEF6	0.162	0.226	-0.256	0.134	0.429	<b>0.865</b>	0.043	0.261	0.182	0.222	0.412
DEF7	0.167	0.192	-0.323	0.030	0.365	<b>0.841</b>	0.013	0.202	0.249	0.151	0.458
IMP1	-0.163	-0.194	0.011	-0.013	0.164	0.034	<b>0.893</b>	0.053	-0.036	-0.005	-0.063
IMP2	-0.139	-0.177	0.037	-0.064	-0.018	-0.070	<b>0.901</b>	-0.115	-0.161	-0.173	-0.142
IMP3	-0.116	-0.105	-0.049	-0.092	0.159	0.006	<b>0.857</b>	0.089	-0.114	-0.200	-0.091
IMP4	-0.098	-0.094	0.032	0.031	0.111	0.037	<b>0.800</b>	0.000	0.034	-0.001	-0.025
IMP5	-0.140	-0.143	-0.019	-0.027	0.139	-0.017	<b>0.892</b>	-0.059	-0.019	-0.158	-0.107
CAP1	0.155	0.353	-0.146	-0.125	0.150	0.281	-0.151	<b>0.788</b>	0.266	0.338	0.379
CAP2	0.015	0.250	-0.100	-0.077	0.190	0.334	-0.038	<b>0.866</b>	0.299	0.439	0.436
CAP3	0.082	0.331	-0.106	-0.094	0.060	0.236	-0.020	<b>0.833</b>	0.190	0.279	0.327
CAP4	0.051	0.259	-0.192	-0.072	0.326	0.443	-0.049	<b>0.897</b>	0.376	0.487	0.594
CAP5	-0.047	0.206	-0.197	-0.063	0.332	0.335	0.056	<b>0.875</b>	0.143	0.348	0.447
CAP6	0.022	0.186	-0.051	-0.149	0.200	0.260	0.052	<b>0.848</b>	0.147	0.402	0.486
CAP9	0.067	0.211	-0.147	0.017	0.192	0.285	-0.029	<b>0.871</b>	0.279	0.450	0.405
REL3	0.205	0.412	-0.045	-0.085	0.241	0.397	-0.127	0.335	<b>0.928</b>	0.402	0.411
REL4	0.316	0.468	-0.097	-0.066	0.210	0.213	-0.157	0.253	<b>0.888</b>	0.326	0.378
REL5	0.287	0.348	0.025	-0.220	0.051	0.139	0.031	0.190	<b>0.885</b>	0.319	0.255

(Table 5-18 cont.)

	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
TRU1	0.014	0.104	-0.007	0.218	0.176	0.124	-0.112	0.309	0.273	<b>0.836</b>	0.334
TRU2	0.027	0.166	-0.159	-0.003	0.168	0.182	-0.175	0.453	0.277	<b>0.855</b>	0.383
TRU3	-0.007	0.192	0.021	0.019	0.260	0.197	-0.121	0.403	0.355	<b>0.788</b>	0.350
TRU4	0.033	0.196	-0.059	0.039	0.109	0.234	-0.097	0.462	0.365	<b>0.852</b>	0.383
TRU5	0.079	0.130	-0.005	-0.038	0.116	0.083	-0.154	0.262	0.341	<b>0.787</b>	0.248
ADPGEN	0.081	0.340	-0.299	0.169	0.523	0.518	-0.169	0.502	0.274	0.435	<b>0.919</b>
ADPMOST	0.182	0.413	-0.234	0.080	0.440	0.493	-0.098	0.497	0.380	0.385	<b>0.906</b>
ADPTIME	0.206	0.425	-0.284	0.193	0.464	0.444	-0.095	0.466	0.301	0.386	<b>0.844</b>
APPTOTAL	0.165	0.394	-0.393	0.026	0.514	0.553	-0.130	0.488	0.364	0.351	<b>0.879</b>
ADPPEREC	0.052	0.299	-0.238	-0.069	0.328	0.476	-0.097	0.434	0.363	0.371	<b>0.845</b>
ADPBUDG	0.004	0.281	-0.251	0.001	0.359	0.485	0.014	0.284	0.357	0.205	<b>0.757</b>

In addition to item loading and ICR, AVE was also checked to ensure the reliability of the instrument. In the second data set, AVEs of all constructs were larger than 0.5.

Hence, after the instrument passed all these examinations, the instrument presented good reliability.

#### 5.2.3.4 Assessment of Discriminant Validity

Following the reliability check, the next step was to examine discriminant validity. Similar to the examinations conducted in the first data set, cross-loadings and average variance extracted (AVE) were analyzed for discriminant validity of the measurement.

First, the exact procedures described in the data analysis of the first data set were followed, and cross-loading check was processed by using PLS Graph and SPSS.

PLS Graph was used to generate the latent variable scores for each item on all the latent constructs remaining in the refined model. After the raw scores of all the items had been standardized in SPSS, SPSS 11.5 was used to calculate the Pearson's correlation coefficients for all the items against the latent variable scores. The correlation results were computed and are presented in Table 5-18.

In the Table 5-18, all the items loaded higher on the construct that they were supposed to measure, compared to any other constructs. All items loaded no more than 0.707 on all other

constructs that they were not theoretically specified to measure. Hence, this cross-loading check indicated that all these fifty-four items can load uniquely on the specified constructs.

Second, AVEs and PHI matrix were analyzed to test discriminate validity. Table 5-19 shows the correlations among the constructs and square root of the AVE. Diagonal elements show the square root of the AVE, whereas the off-diagonal elements show the PHI matrix of latent construct correlations. In this study, the correlations between two constructs were smaller than both of the square roots of AVE.

**Table 5-19 Correlations between latent constructs (PHI matrix) and square root of AVE comparison in survey two**

	AVE	UNCAMA	UNCAMI	ASSE	ASSI	COS	DEF	IMP	CAP	REL	TRU	ADOPT
<b>UNCAMA</b>	0.792	<b>0.885</b>										
<b>UNCAMI</b>	0.934	0.668	<b>0.966</b>									
<b>ASSE</b>	0.795	-0.117	-0.234	<b>0.892</b>								
<b>ASSI</b>	0.795	0.058	0.044	0.029	<b>0.892</b>							
<b>COS</b>	0.622	0.113	0.345	-0.425	0.253	<b>0.789</b>						
<b>DEF</b>	0.796	0.175	0.309	-0.413	0.050	0.487	<b>0.892</b>					
<b>IMP</b>	0.756	-0.153	-0.171	0.001	-0.054	0.105	-0.022	<b>0.869</b>				
<b>CAP</b>	0.730	0.055	0.293	-0.158	-0.090	0.252	0.371	-0.030	<b>0.854</b>			
<b>REL</b>	0.810	0.293	0.454	-0.044	-0.133	0.192	0.289	-0.097	0.294	<b>0.900</b>		
<b>TRU</b>	0.679	0.033	0.196	-0.056	0.055	0.202	0.208	-0.159	0.471	0.391	<b>0.820</b>	
<b>ADOPT</b>	0.739	0.139	0.419	-0.332	0.083	0.516	0.576	-0.118	0.524	0.391	0.419	<b>0.859</b>

Notes: The colored diagonal elements are the square root of the variance shared between the constructs. Off diagonal elements are the correlations between constructs.

## 5.2.4 Structural Model

After completing the assessment of the measurement model, reliability and validity were established for each instrument. The next step was to test the proposed relationship among the constructs by running a structural model.

PLS Graph 3.0 was used to test all the proposed hypotheses. Similar to the analysis in the first data set, first the  $R^2$  test and the significance of path coefficient were examined. In this study, all the exogenous factors in the model explained 48.9 percent of ASP adoption intention. Uncertainty and asset specificity explained 33 percent of cost benefits variance. ASP's capability and social/personal relationship explained 29.2 percent of trust variance. F-test was conducted to

test the significance. The final results are shown in Table 5-20. All  $R^2$  values were significant ( $P \leq 0.001$ ).

**Table 5-20 F-test for  $R^2$  in the model in survey two**

	$R^2$	F	P(F)
<b>COS</b>	0.330***	5.067	0.000
<b>TRU</b>	0.292***	6.104	0.000
<b>ADOPT</b>	0.489***	11.643	0.000

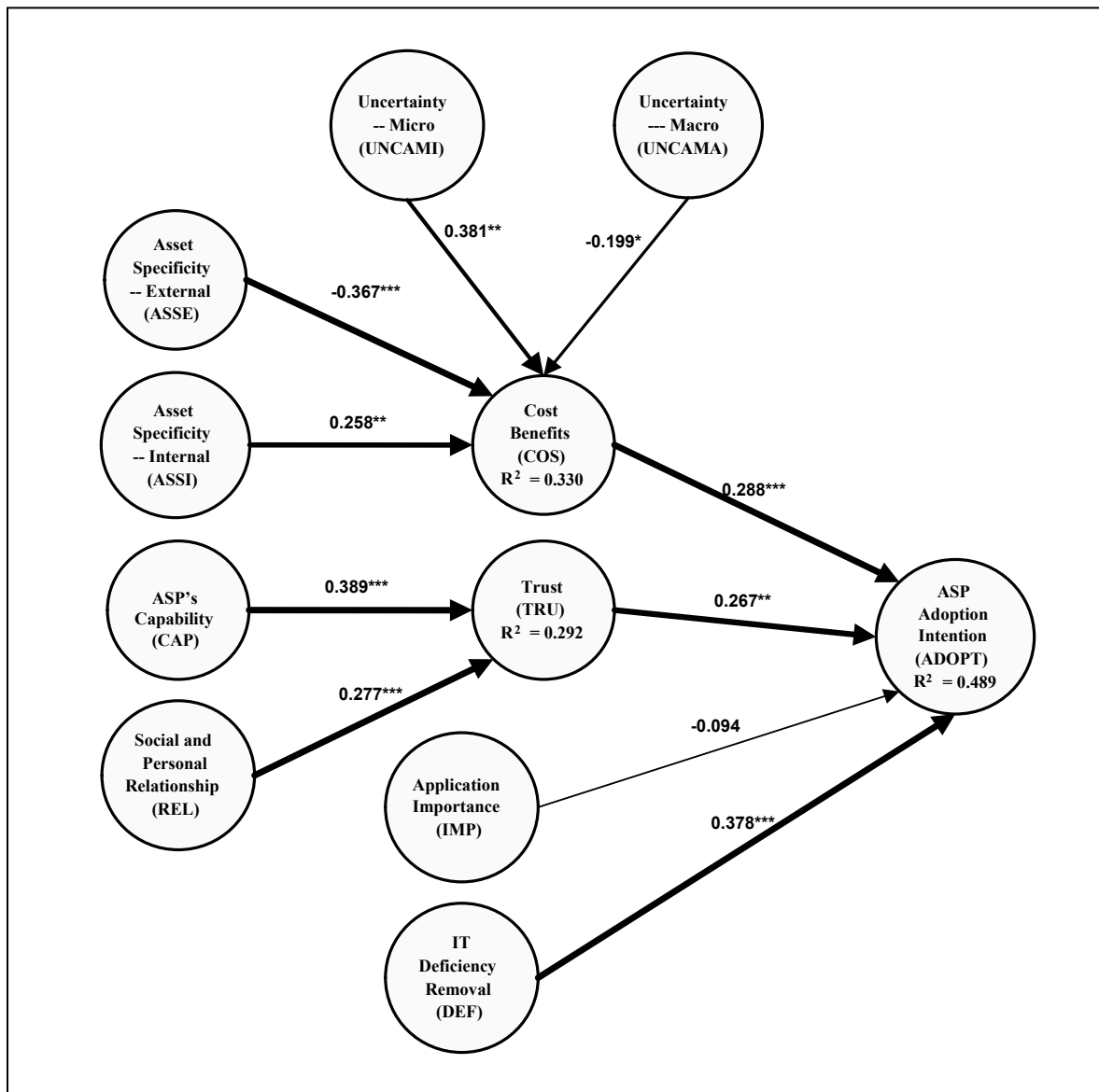
The second measure of the structural model provided by PLS is the path coefficients that indicate the strength of the relationship between two constructs (Wixom and Watson, 2001). The bootstrap procedure with 200 resamples calculated the significance of these path loadings. Figure 5-3 presents the structural path diagram with the path coefficients. All paths were statistically significant at the different alpha level of 0.01, except two paths. The path loading between uncertainty at the macro level (UMCAMA) and cost benefits (COS) was only significant at the alpha level of 0.05. The path loading between application importance (IMP) and adoption (ADOPT) was not significant, as the t-value was only 1.12.

Though the path between UMCAMA and COS was less significant than the path between UMCAMI and COS, two constructs representing uncertainty at both the macro and micro levels had significant relationships with cost benefits. Specifically, uncertainty at the micro level had a strong positive impact on the cost benefits ( $p < 0.001$ ). Respondents seemed to have the notion that high uncertainty associated with business operations of each company will increase cost benefits of ASP adoption. Moreover, uncertainty at the macro level had a negative impact on cost benefits. Respondents seemed to think that macro environmental uncertainty will decrease the cost benefits of ASP adoption. Hence, H1 was partially supported by this data set.

External asset specificity (ASSE) had a negative relationship with cost benefits of ASP adoption, while internal asset specificity (ASSI) had a positive relationship with cost benefits. External asset specificity looked at the investment of ASPs on clients' operations due to the uniqueness of the request. Internal asset specificity examined the uniqueness of clients' operations by a comparison with peer companies. Respondents took the two constructs differently when they considered the cost benefits. According to the definition and explanation of



asset specificity in the study, ASSE, which had a better representation, had a strong negative relationship with cost benefits. This result revealed that the high asset uniqueness required to produce an online application will reduce the cost benefits associated with ASP adoption. Thus, H2 was supported by ASSI in this data set.



\* indicate significant paths: \*\*\*  $P < 0.001$ , \*\*  $P < 0.01$ , \*  $P < 0.05$

**Figure 5-3 ASP adoption decision model in survey two**

As to cost benefits, among non-current ASP clients, cost benefit was a very important factor impacting their ASP adoption intention. Cost benefits had a strong positive influence on ASP Adoption Intention ( $\lambda = 0.292$ ,  $t\text{-value} = 0.404$ ). This result matched the proposed hypothesis that high cost benefits will increase ASP adoption. Hence, H3 was supported by this data.

Social and personal relationships also significantly impacted clients' trust with an ASP ( $\lambda = 0.277$ ,  $P < 0.001$ ). This finding suggested that a close relationship between the two companies and their managers will significantly increase clients' trust towards an ASP company. H4 was supported by this data.

ASP capability significantly impacted trust reflected by very strong path coefficients ( $\lambda = 0.389$ ,  $P < 0.001$ ). This finding suggested that an ASP's high capability leads to high levels of trust towards this ASP. Therefore, H5 was supported in this data set.

Respondents considered trust to be a critical decision factor for ASP adoption intention. The path loading was 0.267 and the p-value was less than 0.01. This result suggested that levels of client trust towards an ASP vendor will result in a higher intent to adopt an ASP. The data supported H6.

Internal IT deficiency removal significantly influenced ASP adoption intention. The path loading was 0.378 and the p-value was less than 0.001. This result confirmed hypothesis 7, suggesting that if the ASP alleviates a client's IT deficiency, then the client is more willing to adopt an ASP. The data supported H7.

The relationship between application importance and ASP adoption intention was insignificant. Though the direction of the path was negative, as proposed in the conceptual model, the path loading was not significant ( $t = 1.12$ ). This result referred to the fact that respondents did not think that they should outsource less important applications. The data in this case did not support H8.

After all the main effects of all the factors on ASP adoption had been assessed by the structural model, tests for the moderating effect of trust were conducted.

### 5.2.5 Moderating Relationship

In addition to assessing the main effect of each factor, tests for the moderating relationship of trust upon economic factors (cost benefits) and strategic factors (application importance and IT deficiency removal) were further conducted.

PLS Graph 3.0 generated latent variable scores for all the constructs. Three interaction constructs (TRU\*COS, TRU\*DEF, TRU\*IMP) were calculated by multiplying latent scores of TRU with COS, DEF, and IMP, respectively. Then, a regression model was developed to assess the three interaction effects individually and collectively.

The moderating effect was assessed by the path coefficients of the interaction variable in the regression model. A significant interaction coefficient suggested that a moderating effect existed (Bollen and Paxton., 1998). The beta coefficients of four interaction models are presented in Table 5-21.

In the table, the first three models tested three interactions independently. As the direction of the moderating relationship had been specified in the established model, a one-tailed t-test was performed to test the significance of path coefficients.

In the individual models, the beta of TRUCOS was marginally significant. The beta (-0.137) was marginally significant at an alpha level of 0.05. This result suggested that when the standard deviation is increased by 1, the influence of cost benefits on ASP adoption intention will be decreased from 0.255 to 0.118, which was proposed by Hypothesis 9.

Beta values of TRUIMP and TRUDEF were not significant at the alpha level of 0.05. The results showed that in individual interaction tests, the interaction effects of trust on application importance and IT deficiency removal were not significant. However, in the overall model including three interaction variables, the beta value of TRUCOS and TRUDEF became significant at the alpha level of 0.05. This result suggested that when the three interaction effects played together, the interaction effects of trust on cost benefits and IT deficiency removal were significant. As all these three interactions were proposed to exist in the same model simultaneously, whereby these interactions may impact each other to some extent, the path

coefficients in the full model were more accurate and important to examine the interaction effects than the results in the individual models.

**Table 5-21 Beta significance in four interaction models in survey two**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. (one-tail)
		B	Std. Error	Beta		
TRU*COS	COS	0.255	0.098	0.255	2.611	0.005
	IMP	-0.115	0.084	-0.115	-1.360	0.089
	DEF	0.398	0.095	0.397	4.173	0.000
	TRU	0.282	0.086	0.282	3.281	0.001
	TRUCOS	-0.132	0.082	-0.137	-1.605	0.056
TRU*IMP	COS	0.279	0.097	0.279	2.867	0.003
	IMP	-0.104	0.085	-0.104	-1.215	0.114
	DEF	0.379	0.096	0.378	3.954	0.000
	TRU	0.264	0.087	0.264	3.047	0.002
	TRUIIMP	-0.055	0.073	-0.064	-0.757	0.226
TRU*DEF	COS	0.283	0.096	0.283	2.932	0.002
	IMP	-0.092	0.085	-0.092	-1.086	0.141
	DEF	0.384	0.096	0.383	4.015	0.000
	TRU	0.256	0.087	0.256	2.946	0.002
	TRUDEF	0.084	0.079	0.089	1.066	0.145
Full-Model	COS	0.227	0.098	0.227	2.324	0.011
	IMP	-0.114	0.084	-0.114	-1.359	0.089
	DEF	0.418	0.095	0.418	4.403	0.000
	TRU	0.268	0.085	0.268	3.141	0.001
	TRUCOS	-0.200	0.093	-0.207	-2.142	0.018
	TRUIIMP	-0.004	0.075	-0.004	-0.049	0.480
	TRUDEF	0.161	0.086	0.170	1.869	0.033

More specifically, the beta value of TRUCOS was -0.207, which was stronger than the beta in the individual test. This result suggested that when the standard deviation of trust increases by 1, then the impact of cost benefits on ASP adoption intention will decrease from 0.227 to 0.02. Thus, high levels of trust can reduce the impact of the cost benefits associated with ASP intention to adopt, as proposed by Hypothesis 9.

The beta of TRUDEF was 0.170. This result suggested that when the standard deviation of trust increases by 1, the impact of IT deficiency removal on the ASP intention to adopt will increase from 0.418 to 0.588. Thus, a high level of trust will encourage the intention to outsource by alleviating internal IT deficiency, as proposed by Hypothesis 10b. In this full model, the beta of TRUIIMP was not significant, meaning that there was no interaction effect on application importance.

Overall, by examining the three individual models and the full model together, it was found that trust had the moderating influence on cost benefits and IT deficiency, but not on application importance.

In addition to examining the path significance of interaction constructs with ADOPT, similar to the analysis in survey one, the change of  $R^2$  between the interaction model and the main effect model was examined for effect size. The significance of an  $R^2$  change indicates contribution of interaction variables to the explanation of variance. The  $R^2$  changes between the interaction model and main effect model were calculated in SPSS. Besides, Cohen's  $f^2$  was calculated to check effect size. The final results and effect size of interactions are presented in Table 5-22.

**Table 5-22  $R^2$  changes between interaction models and main effect model in survey two**

Model	R Square	Std. Error	R Square Change	F Change	Sig. F Change (p-value)	$f^2$
Main Effect	0.489	0.738				
TRU*COS	0.507	0.730	0.017	2.577	0.113	0.035
TRU*IMP	0.493	0.740	0.004	0.573	0.451	0.008
TRU*DEF	0.497	0.737	0.008	1.137	0.290	0.008
Full Model	0.530	0.722	0.041	2.093	0.109	0.073

First, look at effect size of each interaction. The interaction effect of trust on the full model was at the higher end of the moderate level ( $f^2 = 0.073$ ). The effect size of trust interaction on cost was at the lower side of the moderate level ( $f^2 = 0.036$ ). The interaction effects of trust on application importance and IT deficiency were relatively small (for cost benefits,  $f^2 = 0.008$  and for IT deficiency removal,  $f^2 = 0.008$ ). Obviously, when the three interaction effects played together, the total effect size appeared to be stronger.

Then, look at  $R^2$  change between each interaction model and main effect model. Usually, a small  $R^2$  change means the introduction of an interaction effect does not add more power to the variance explanation of the dependent variable. In the three individual interaction tests, there were no significant increases on  $R^2$ . However, in the full interaction model, the increase of  $R^2$  was 0.041. This result suggested that compared with the main effect model, the three interaction relationships contributed 4.1 percent more to the variance explanation of the whole model. The p-value from the F-test showed that the change was marginally significant at the alpha level of 0.1.

When all the results of the moderating relationship tests were taken into consideration, it was determined that significant beta values of TRUCOS and TRUDEF indicated the existence of two moderating effects in the model. However, the marginal significance of  $R^2$  change showed that these interactions effects did not make a large enough contribution to the variance explained by the whole model. Hence, in the study, the moderating effects of trust on cost benefits and IT deficiency removal were only marginally supported. In another word, Hypothesis 9 and 10b were marginally supported and Hypothesis 10a was not supported in this data set. Future studies in a more homogeneous sample should be conducted to further test these interaction relationships.

The results obtained from this hypothesis testing for non-current ASP clients are summarized in Table 5-23.

**Table 5-23 Summary of results in survey two**

Number	Hypothesis	Results
H1	A higher level of environmental uncertainty will lead to greater cost benefits associated with ASP adoption.	Partially Supported*
H2	A higher level of asset specificity will lead to less cost benefits associated with ASP adoption.	Supported
H3	Perceived higher cost benefits associated with ASP adoption lead to a <b>higher level of ASP adoption intention</b> .	Supported
H4	A closer social and personal relationship between managers of an ASP and their client will lead to higher levels of trust in the ASP.	Supported
H5	A perceived higher level of ASP capability will lead to a higher level of trust in the ASP.	Supported
H6	A higher level of trust between the ASP and the ASP client will result in a <b>higher level of ASP adoption intention</b> .	Supported
H7	As the perceived ability of an ASP to eliminate a client's IT deficiency increases, <b>the ASP adoption intention</b> increases.	Supported
H8	A higher level of application importance will result in a <b>lower level of ASP adoption intention</b> .	Not supported
H9	Trust will moderate the relationship between cost benefits and <b>the of ASP adoption intention</b> such that when trust is high, there is a less positive relationship between cost benefits and <b>the ASP adoption intention</b> than when trust is low.	Marginally Supported
H10a	Trust will moderate the relationship between application importance and <b>the ASP adoption intention</b> such that when trust is high, there is a less negative relationship between application importance and <b>ASP adoption intention</b> than when trust is low.	Not Supported
H10b	Trust will moderate the relationship between IT deficiency removal and <b>the ASP adoption intention</b> such that when trust is high, there is a more positive relationship between IT deficiency removal and <b>the ASP adoption intention</b> than when trust is low.	Marginally Supported

\* Macro-uncertainty is supported to positively impact cost benefits; micro-uncertainty is not supported to positively impact cost benefits.

## **CHAPTER 6 DISCUSSION AND CONCLUSION**

In Chapter 5, the results of two survey studies are presented. This chapter discusses further the results from the perspective of the underlying theories assumed. The limitations of this study are then addressed, followed by the contributions. Finally, future research directions are presented.

### **6.1 Discussion**

This dissertation study investigates the factors that influence the ASP adoption decision. Two separate surveys were conducted among current clients of an ASP and companies that are not using ASP applications, respectively. In addition, some qualitative data from case interviews were collected to examine the decision factors associated with outsourcing an online course management system. Based on the statistical results presented in the previous chapter, this section will interpret the results and elaborate on the impact of these factors on the ASP adoption decision and further implications.

#### **6.1.1 Economic Perspective**

##### **6.1.1.1 Uncertainty**

Hypothesis 1 examined the effect of uncertainty on the cost benefits associated with the ASP adoption. Specifically, uncertainty was proposed to have a positive impact on cost benefits of outsourcing an online application. In the survey studies, the results showed that the construct of uncertainty broke into two parts: micro uncertainty and macro uncertainty. Micro uncertainty examined the extent of uncertainty from an individual company's perspective, such as changes to specific business operations and client requirements. Macro uncertainty examined the extent of uncertainty from a broader view, such as changes in economic conditions and market competition.

The findings from the LASP survey showed that macro uncertainty had a negative impact on cost benefits associated with ASP adoption, whereas micro uncertainty had a positive

impact on cost benefits. Moreover, results from the TCE survey among companies that were not using ASP applications showed that macro uncertainty had a marginally significant negative impact on ASP adoption cost benefits, whereas the micro uncertainty had a significantly positive impact on cost benefits. The companies that were not current ASP clients expressed serious concern toward the environmental change directly associated with their business rather than the changes associated with the whole market and economy.

Moreover, the qualitative data also showed uncertain client requirements were considered to be an important factor influencing cost benefits. For example, an informant commented that

“As the number of users is increasing so quickly, the extended enterprise edition applications need at least eight more servers to run. Thus, the university has to buy more computer servers. It is a huge amount of money. Also, if we buy more servers, they would need to hire more IT professionals to maintain these servers and run the applications.”

Based on the results of both surveys, it was found that uncertainty regarding the whole market and the economy had a negative impact on the cost benefits of ASP adoption. A possible explanation for this impact is that these unpredictable changes will increase the risks of outsourcing and reduce the cost benefits. When the whole market is changed, the survival of a company and its future development direction are hard to predict. In such a situation, a company needs more control of its applications to reduce the risks.

Moreover, when the market and the economy change, a client may terminate its contract with an ASP or make significant changes in its application requirements from the ASP. Then, ASPs may have to increase monthly fees in order to successfully respond to these changes quickly, so the client's cost benefits gained from outsourcing may be reduced. In addition, when the macro uncertainty is high, mergers and acquisitions would also threaten ASPs. Some ASPs even might not be able to continue in business. Gartner (2003) reported that more than 40% of ASPs have been out of the market in the past two years. In this case, clients have to switch to other ASPs or move the application in-house. Thus, the instability of ASPs will reduce clients' cost benefits from an ASP.



However, when the whole market and the economy are stable, changes to clients' business operations or requirements may show more cost benefits from outsourcing. When working with ASPs, clients can easily extend business functions or increase monthly application usage without any significant investment. Just as proposed in the ASP adoption-decision model, the flexibility (e.g., application scale-up and technology upgrades) associated with the features of the ASP business model – short-term contact and predictable monthly fees - can help the clients gain more cost benefits when the micro uncertainty is increasing.

Based on these findings, it might be argued that the macro uncertainty within the whole market and the economy may reduce the cost benefits of ASP adoption, whereas the micro uncertainty associated with individual companies may increase the cost benefits of ASP adoption, as confirmed by the practice of companies during the 1990s (Lacity and Willcocks, 2001). In the middle 1990s, many companies needed ASPs to help them achieve cost benefits. When the development of the whole economy became stagnant around 2000, cost benefits were lessened and demands for ASPs were significantly reduced.

#### **6.1.1.2 Asset Specificity**

Hypothesis 2 examined the impact of asset specificity on the ASP adoption decision. Specifically, it was proposed that high asset specificity will reduce the cost benefits associated with the ASP adoption.

In the survey studies, it was found from factor analysis that eight questions measuring asset specificity were divided into two groups. One group of questions measured the uniqueness of applications from an external perspective by estimating an ASP's investment in order to deliver the required applications. The other group of questions measured the uniqueness of applications from an internal perspective by comparing clients' requirements of Information Systems resources with peer companies. The findings from the two data sets showed that both external asset specificity and internal asset specificity had a significant impact on cost benefits.

High uniqueness of application may reduce the possible cost benefits obtained from an ASP, since these applications require an ASP to make specific investments in software, hardware or labor, in order to deliver the required applications. These costs are more or less, transferred

into clients' renting costs. In such cases, clients' cost benefits will be reduced. Respondents in these surveys deemed that it was not economical to have ASPs make significant investments to provide their unique applications. This finding gives a good guide to ASPs on application selection. The applications that are based on proven industry standards and best practices, such as payroll processing, human resources, point of sale, document management, etc., may present an attractive business case for hosting services, whereas an application that is highly tailored to a specific company's requirements might not be a good candidate.

Interestingly, based on the respondents of this study, it was also found that companies who perceive their internal systems to be highly customized tend to believe that the ASP business model has considerable cost benefits. In this case, an ASP could assume all the responsibility of handling systems, such as developing, maintaining, and updating the systems. Thus, high internal production costs associated with the highly unique systems can be greatly reduced. However, the respondents assumed that ASPs could easily provide these unique applications. Cost benefits exist only when this assumption is true. The question here is whether current ASPs would be able to provide a highly customized application economically. It is not clear, at this point, how this could be feasible.

On the other hand, this finding implies that clients have a strong intention to outsource highly unique systems in order to remove the burdens of systems development, maintenance, and updates. Thus, to some extent, it may be reasonable for an ASP to provide customized applications to satisfy clients' special requirements. But this conclusion is valid only when ASPs do not need to invest significantly relative to client's investment; otherwise, clients may not be able to gain cost benefits. In this situation, the other alternative for ASPs is to deliver applications for specific industries, which is a trade-off between case-by-case customization and pure standardization.

Based on these findings, it can be argued that high asset specificity may lead to low cost benefits. But if an ASP can provide a unique application at a reasonable price, then a company may have a stronger intention to outsource this unique application to reduce internal production costs.

### 6.1.1.3 Cost Benefits

Hypothesis 3 investigated the impact of cost benefits on the ASP adoption. Specifically, it was proposed that the higher the cost benefits clients can achieve, the more they are willing to adopt the ASP business model.

The surveys among the two data sets yielded slightly different results. Among the group of LASP's clients, cost benefits have a marginally significant impact on ASP adoption. In the data set of companies who were not using ASP adoption, this positive path loading was very significant at the alpha level of 0.001. Moreover, case interviews showed that cost benefits were cited as an important factor impacting the university's ASP adoption decisions. An informant said that

“The cost to get the [software license] version we really need to do [functions] properly and to get the hardware, using multiple servers, not one machine, has become a problem. Most recently, we have found a way to address [this problem]... [what] we are actually to do instead of buying machines and working in campus... [is] outsourcing.”

In this project, the big savings on server investment and IT professional hiring have a significant impact on the university's outsourcing decision on online course management systems. Therefore, cost benefits have a positive impact on the decision of ASP adoption.

However, among the LASP's clients, cost benefits are not considered to be a very important factor for ASP adoption. The possible explanation of the marginally significant relationship could be the specific application. These clients were all using online credit lending systems from LASP. The cost benefit associated with a specific application may not be very significant, though it is considered to be a decision factor. This effect needs to be further assessed in subsequent surveys among clients of other ASPs. Moreover, another possible explanation is that ASP clients do not take cost benefits as a very important factor. A survey among Irish companies that have adopted ASP applications found that most of them did not realize the cost benefits when they rented the application (CGEY, 2002). To these adopters, cost benefits are not the only and most important objective they are looking for. An additional explanation of the insignificant relationship is that even though the questions asked clients'

considerations before they made the decision, most clients' successful experiences with LASP still impact their responses on cost benefits. The satisfied services and trust with LASP make these clients less concerned with cost benefits associated with ASP adoption.

These findings support the idea that cost benefits positively impact clients' ASP adoption decision, but this factor may not be the most important determinant. The findings may have implications for ASP marketing strategies. ASPs need to highlight the cost benefits of using their applications, but it is perhaps not wise to overemphasize this benefit, as its exact influence on the decision process is not always obvious.

## **6.1.2 Social Perspective**

### **6.1.2.1 Social and Personal Relationship**

Hypothesis 4 was designed to investigate the impact of the social and personal relationship on a client's trust in an ASP. Specifically, it was proposed that a significant social and personal relationship should increase clients' trust in an ASP.

The results from both survey studies show that close social and personal relationships with ASPs could impact clients' trust in these ASPs. The respondents all expressed the desire to know the ASP and its managers. Though in both data sets, the impact of social and personal relationship on trust is not as significant as that of ASP's capability on trust, these participants all considered social and personal relationship as an important factor to increase their trust in an ASP. It was found that companies usually lacked the capability to estimate ASP's technical competence. Social and personal contacts between managers in trade shows, exhibitions, and promotion activities can help companies know more about ASPs. Good impressions about ASPs and their applications lead to higher levels of trust in the ASPs.

Moreover, the qualitative data collected from the project showed that the university had social and personal relationships with Blackboard Company and its managers before it finally made the ASP adoption decision. The university put a great effort into their relationship with this ASP. For example, the IT managers of the university attended vendor trade shows and the university invited the Blackboard Company to have on-site demos and trial. These efforts helped to increase the trusts in the Blackboard Company. Though the decision makers of the university

thought that the personal relationship did not impact their outsourcing decision directly, they agreed that the social and personal relationship enhanced their trust in Blackboard Company's intention and capability to deliver quality applications. With good relationship, the university knows the company will give it special attention and response to the request quickly.

Based on these findings, it can be argued that a social and personal relationship between managers on both sides has a positive impact on a client's trust in an ASP. A client can know an ASP better, e.g. tracking records, ASP leadership and management positions, and financial stability, through social and personal activities. Moreover, these informal or formal relationships between the two companies and their managers can assure that the ASP will be responsive to their needs. When a problem reaches the management level, the manager can ensure that the ASP CEO will be there and will make client's problem a high priority.

These findings imply that ASPs should expose themselves to potential client companies so that clients can understand their market. It is also implied that ASPs need to establish personal relationships with these potential client companies. All these pre-sales and marketing activities are helpful in gaining the trust of their prospective clients.

#### **6.1.2.2 ASP's Capability**

Hypothesis 5 was designed to examine the impact of ASP's capability on trust. Specifically, it was proposed that ASPs' high capability will increase clients' trust in ASPs.

The results from both surveys show that an ASP's high capability will increase clients' trust in that ASP. The path loadings of capability on trust in two models were very significant at the alpha level of 0.001. Both the business understanding and technological capabilities of ASPs can help to gain more trust from the clients. It was found that both groups of clients emphasized business capabilities more, such as the ability to understand business processes and business objectives. To the technical capabilities, they focus on the security of data storage and stable network connection. This finding is further confirmed by the data gathered from the online course management systems. For example, the Blackboard Company demonstrated a strong capability in providing applications that meet and exceed the expectations of the faculty and

students, which further increased the university's trust in the Blackboard Company. As an informant said,

“We are satisfied with the services provided by Blackboard. Every time when we have problems, they can give helpful and effective support on the system. We have no problem with their services.”

Additionally, it was found that the current clients of an ASP generally place a high value on ASP capability. However, the companies that have not adopted ASPs had much lower evaluations regarding ASP capabilities in the market. This finding could help explain the low adoption rate of the ASP business model currently observed in the market. Many ASP prospects perhaps feel that there are no qualified ASP vendors for them to choose from, though they may be attracted to the ASP business model.

Based on these findings, it can be argued that an ASP's capability, including both business knowledge and technical competency, is considered to be an important ASP adoption decision factor. Hence, ASP companies should try more to increase and present their capabilities to their clients in order to increase their clients' trust. More specifically, ASPs should show their strong expertise in understanding the business process within their clients' domain and their technical ability in handling online application delivery. It is very important for ASPs to demonstrate their capabilities to clients through various channels. For example, previous success stories and client references can be provided as evidence of the ASPs' strong capabilities.

### **6.1.2.3 Trust**

Hypothesis 5 was designed to examine the impact of trust on clients' ASP adoption decision. More specifically, it was proposed that increasing trust would increase the likelihood of a favorable ASP adoption decision.

The two survey studies showed that trust has a significant impact on the clients ASP adoption decision. The respondents indicate that higher trust in ASP vendors will increase the likelihood of a favorable ASP adoption decision. Specifically, all of the current LASP clients surveyed had a relatively high level of trust in their current vendors, when they made the decision to adopt an ASP application. Moreover, in the TCE survey, the researcher personally

talked with some companies during the period of telephone reminder. Some companies expressed a low level of trust in ASP vendors as a big reason for not adopting the ASP business model, even though these companies noticed other advantages associated with the ASP business model, such as cost benefits and IT deficiency removal.

The results from the university also support the idea that trust was an important factor when the university made the decision to outsource the online course management systems. For example, the university had spent considerable time to ensure that the ASP vendor was reliable before the school made the final ASP adoption decision. An informant emphasized that

“We feel very secure with Blackboard. We feel like if anything goes wrong, we can get instant help. And it’s delivered by specialists in the field, who know what they are doing. So we are not bumped around here for two or three weeks, try[ing] to figure out what is wrong.”

These findings support the hypothesis that trust is an important factor impacting the ASP adoption decision. Hence, it would be helpful for ASPs to increase their efforts to establish and sustain trust with clients, and to alleviate any related concerns of their prospective clients.

### **6.1.3 Strategic Perspective**

#### **6.1.3.1 Application Importance**

Hypothesis 7 was designed to investigate the impact of application importance on clients’ ASP adoption decision. Specifically, it was proposed that the more important the application is, the less likely that the clients will outsource this application to an ASP.

The results of the first survey showed that application importance has a significant impact on ASP adoption. However, this impact was positive, contrary to what was proposed in the conceptual model. The survey showed that this group of current ASP clients was more willing to outsource their important applications. The possible explanation of this positive influence could be the features of the sample population. The sample population in the survey study was decision makers at each client company of LASP. As high-level managers, most of these decision makers would pay more attention to application efficiency and less to the dependence on an external vendor. At this level, these managers will not touch the practical

supporting work, and they do not have the direct need to depend on an external vendor. An ASP with expertise in some applications will help the company to gain more efficiency in providing services. High level managers hence think companies can outsource important applications to an external expert. Another possible explanation is that in LASP's client sample, clients' responses might be impacted by their successful experiences with LASP, so they would like to outsource very important applications.

Moreover, the decision makers at the university stated that the online course management system was very important to the university. It was safer and more efficient to put this important application in an expert's hands. That university has few outsourcing projects, so they did not need to be concerned about high dependence.

However, the findings from the two survey studies had some discrepancies. The finding from the TCE survey showed that the impact of application importance was not significant. There were no strong preferences among these companies regarding whether they should outsource important applications or just keep the outsourced application standard. This discrepancy may be due to the features of the sample. The respondents of the TCE sample were mostly companies that had not outsourced any applications. The definition of important applications varies in the different companies. Even in the same company, the important strategic application might not be commonly agreed upon. A CEO might have an opinion different from that of other executives (e.g., CIO) about important applications. Moreover, this insignificant finding is consistent with the studies of Linder et al. (2003). They also found clients can outsource all kinds of applications, even strategic business.

Based on these findings, no strong conclusion can be drawn about the impact of application importance on ASP adoption in non-current ASP clients. However, current ASP clients were more likely to outsource important applications. Hence, this finding may provide some hints for ASPs to select which applications can be hosted. It is not necessary to host only non-core applications. ASPs may even host important applications if they possess special expertise in that application, as clients tend to believe in the specialty of an ASP in providing better services.



### 6.1.3.2 IT Deficiency Removal

Hypothesis 8 was designed to examine the influences of IT deficiency removal on the ASP adoption decision. More specifically, it suggested that increased desire to remove IT deficiency results in an increased desire to adopt the ASP business model.

The findings from both survey studies showed that IT deficiency removal has a significant positive impact upon the ASP adoption decision. For example, when a company believes that it will complement its internal IT deficiency (i.e., lack of investment in software and hardware, lack of knowledge of handling applications and lack of qualified IT professionals) through ASP services, then the company is more willing to pursue this business relationship.

This finding was further confirmed by the results found from the university case study. Decision makers at the university thought it was wise to outsource their applications because they lacked the knowledge to configure and fine-tune the application very well. Internal IT professionals also did not know the best practice of course management, regarding functionality, human-computer interface, and service delivery and upgrading. Thus, the ASP vendor could help the university to complement its internal IT capability and make the system perform at its best.

“[If we do it internally], you are dealing with a novel implementation where Blackboard has all the experiences and has encountered every problem we are going to have. So when they solve the problem for one, they solve the problem for several institutions. We would not need to redo the work every single time it came out. So [outsourcing is] just more efficient.”

Based on these findings, it can be argued that an increased desire to remove IT deficiency has a significant positive impact on clients' ASP adoption decision. Thus, it will be helpful for ASPs to emphasize their expertise in services and help compensate for the IT deficiency of their clients.

This study also confirmed that another reason for clients to adopt ASP is knowledge transfer. Clients learn from ASPs through collaboration, and this is perhaps the best way to enhance clients' capabilities. For example, the decision makers at the university commented that the university needed to learn the system from the ASP. Then the university could increase its

internal knowledge base and make good preparations for future change, such as taking the systems back home. In this sense, ASPs should make certain preparations for knowledge transfer of best practice (e.g., design of functionality and human-computer interface, and service delivery) and system management. Therefore, clients can benefit more from ASPs and enhance their knowledge about the best practices of the system. In this way, they would be more willing to outsource their application to an ASP.

#### **6.1.4 Moderating Relationship**

Hypotheses were developed to test the moderation effect of trust on the impact of three factors - cost benefits, application importance, and IT deficiency removal – on the ASP adoption decision. Trust here refers to a client's belief that an ASP will have the intention and capability to deliver promised applications.

Hypothesis 9 was designed to investigate the moderating effect of trust on the relationship between cost benefits and ASP adoption. More specifically, it was proposed that a high level of trust will alleviate the impact of cost benefits on ASP adoption.

The findings from the LASP sample found that trust did not have a significant interaction effect on the relationship between cost benefits and ASP adoption. Both the individual interaction model and full model did not have significant beta values for the path coefficient. In the TCE sample, the results suggested that trust has a marginally significant interaction effect on the relationship between cost benefits and ASP adoption. When this group of clients had higher trust in ASPs, they had the tendency to be less concerned about cost benefits obtained from ASP adoption. However, the interaction effect of trust was not significant in the individual model, and the total R square change was not significant in the full model. The few R square changes mean that the introduction of this interaction relationship did not significantly contribute to the explanation of ASP adoption decision. Nevertheless, the data suggests at least the existence of an interaction effect of trust upon cost benefits, although this interaction effect is not very significant. Further research is required to test this moderating relationship with a larger sample size to see if the strength of the interaction effect may increase in a larger context.

The university case study also provided the evidence that this interaction between trust and cost benefits exists. For example, the university gave up webCT as another choice of online course management systems, even though the cost of webCT was less than that of the Blackboard Company. Hence, although the Blackboard Company was more expensive, they chose it because they had more trust in it.

Based on these findings, it can be argued that a high level of trust will somewhat impact the effect of cost benefits upon ASP adoption and it would, subsequently, be helpful for ASPs to develop in prospective clients a higher level of trust towards the ASP model.

Hypothesis 10a was designed to investigate the moderating effect of trust on the relationship between application importance and ASP adoption. More specifically, it was argued that high trust will influence the relationship between application importance and the ASP adoption decision.

The findings from both survey data sets suggested that trust did not have a significant impact on the relationship between application importance and ASP adoption. Interestingly, regarding application selection, trust between the two parties did not significantly change client decision. It implies that enhanced trust will not change the clients' decision regarding which type of applications they choose for outsourcing.

Hypothesis 10b was designed to examine the moderating effect of trust on the relationship between IT deficiency removal and ASP adoption. More specifically, it was proposed that high levels of trust will make clients compensate for their internal IT deficiency better by outsourcing more applications to an external vendor.

The findings from both data sets showed that trust has a marginally significant impact on the relationship between IT deficiency removal and ASP adoption. The qualitative data also showed that the university was more willing to complement its internal IT deficiency when they outsourced applications to a trustworthy vendor. Though the beta value was not very significant, these results could suggest that when trust was higher, the impact of internal IT deficiency removal on the ASP adoption decision would be strengthened. In other words, when trust was

higher, companies were more willing to let ASPs be involved in their business process and remove their internal IT deficiency.

Hence, the presence of social factors has a certain interaction effect on both economic and strategic factors. These findings suggest that when the cost benefits of an ASP are not significant, strong trust between the ASP and its potential clients can help an ASP gain market share over its competitors. Similarly, when an ASP can better remove a client's IT deficiencies, high trust will enhance this advantage. However, in general, trust will not significantly affect clients' consideration of application selections. So, on the one hand, an ASP may not impact a client's decision on the type of application it is willing to outsource by building up trust with a potential client. But, on the other hand, an ASP can enhance its advantages (e.g., high IT deficiency removal) and offset possible disadvantages (e.g., low cost benefits) by establishing a trust relationship with its potential clients.

## **6.2 Study Limitations**

Although a rigorous and comprehensive study was conducted, there are still some limitations associated with this research.

The major limitation of the quantitative study is the small sample size. In the first survey of LASP's clients, the total population was not big. Even though the response rate was very high, the sample size was still relatively small.

In the second survey, the response rate was not very high. There are several reasons for this low response rate. First, due to the features of the population, it was very hard to reach these top executives, as this type of person is typically very busy. Second, many computer executives may not have enough knowledge of the ASP business model. The survey conducted in Irish companies indicated that 50% of executives were not aware of ASP (CGEY, 2002). Similar results may be found in the United States, considering the low adoption ratio. Then this group of people should be excluded from the total sample, as their responses can not help discover the determinants of an ASP adoption decision. Because of this, the total effective sample size might be much smaller than the current number. Counting this effect, the actual response rate would be higher. Third, the names were obtained from a public list, which had been extensively used in the

academic world (Ellen, 2003; Goo, et al., 2002). Thus, these executives may be burned out from participating in other surveys. Fourth, some companies have a policy against responding to surveys. During the telephone reminder, a number of subjects stated this reason for not answering the survey. Last, the questionnaire is relatively long, having over 90 questions, which is known to reduce the response rate.

This low response rate from the second survey resulted in a very small sample size. This small sample size may limit the ability to discover if any effects exist and may impact the interpretation and further generalization of the findings.

Moreover, the first survey study was restricted to the clients of only one ASP within the financial industry. Hence, the findings may not be generalizable to clients using other online applications. However, Grove et al., (1994) indicated that there are no differences of decision factors among different industries, so these results might still provide insights to ASP researchers and practitioners from all industries.

Another challenge with the quantitative study is related to the measurement items. In the measurement for uncertainty, it was not anticipated in the beginning that there were two parts of uncertainty: macro level and micro level. This resulted in only two items being available to measure micro-level uncertainty. This measurement issue might have some impact on reliability of findings. In a future study, further measurements should be developed to determine micro-level uncertainty.

## **6.3 Contributions**

In spite of the limitations discussed, the results of this study nonetheless help both researchers and practitioners interested in understanding the ASP adoption decisions of clients and prospective clients.

### **6.3.1 Contributions to Researchers**

For researchers, this is the first study known to the author that empirically examines clients' determinants of ASP adoption from an integrative perspective. First, special attention is directed toward ASP adoption decisions and the decision factors specifically for ASP adoptions

in contrast to focusing on the factors that affect traditional outsourcing adoptions. This shift of focus is important because traditional outsourcing decisions are distinct from ASP adoption decisions in terms of applications attributes, target clients and vendors. Although prior research has suggested clients should consider a series of determinants when outsourcing an application (Lacity and Heichheim, 1993; Grover, et al., 1998), the features of the ASP business model, such as online delivery, a predictable monthly fees and a short-term contract, dramatically alter clients' outsourcing concerns. This ASP adoption decision model thus highlights the special nature of the ASP business model and draws attention to the factors that are particularly important in the ASP adoption decision.

Moreover, the ASP adoption decision model is distinct from the other IS outsourcing decision models by bringing a comprehensive view to investigate this complex decision-making process. It is a unique view to use the three perspectives - economic, strategic, and social - together. In this way, this study avoids the bias introduced by focusing on only one perspective and the danger of overlooking the effects of other important variables not included in that single perspective. The empirical data have demonstrated the effectiveness of this comprehensive ASP adoption decision model in practice.

In addition, the results from this study elucidated the independent impact of each perspective and the interactions among these three perspectives, specifically the moderating effects of the social perspective, in the form of trust, upon the other two. Some findings from both surveys are consistent with the findings in previous IS outsourcing studies. For example, IT deficiency removal and trust still have a significant impact on the ASP adoption decision; ASP capability, and social and personal relationships have an effect on a client's trust in an ASP. It is interesting to find that uncertainty at the macro level and micro level, respectively, has a different impact on cost benefits associated with the ASP adoption decision. The uncertainty at an individual company level will enhance cost benefits while uncertainty at the market and economy level will alleviate cost benefits. Compared with previous IS outsourcing studies, the distinction of these two levels of uncertainty can help to more accurately assess uncertainty. In addition, though high asset specificity will obstruct outsourcing, clients still hope qualified ASPs will provide their unique applications in order to gain cost benefits by removing their internal burden. Moreover, the impact of application importance was not consistently significant, which

suggests that the long held belief that important applications are not suitable for ASP hosting needs further consideration. Furthermore, the explored moderating relationship suggested an important role of trust in the whole decision process. All these findings significantly contribute to a comprehensive understanding of ASP adoption decisions.

### **6.3.2 Contributions to Practitioners**

For practitioners, this is an empirical study that focuses on the ASP market. Due to the unique features of the ASP business model, this study can shed insight on the special determinants in ASP adoption. Especially in the current economic situation, these findings can give ASP vendors a better idea about clients' concerns for ASP adoption and adjust their marketing or production strategies appropriately. The study found that most factors have an important impact on clients' decisions, with the exception of application importance. Cost benefits, IT deficiency removal, and trust play an important role in influencing clients' ASP adoption decision. ASPs need to emphasize their capabilities to complement clients' lack in IT resources and cost advantages associated with the ASP business model. The results also revealed that application importance does not have a consistent impact on ASP adoption. Attitudes to outsourcing important applications vary in different companies. The advice to ASPs is that ASPs should investigate extending the scope of their hosted applications.

Moreover, the findings about the moderating relationships suggest that the clients' trust that an ASP could possibly provide the services necessary to benefit the clients' business changes the impact of economic and strategic factors on ASP adoption decisions. The clients' trust in an ASP might motivate clients to be less concerned about cost benefits or to compensate more for internal IT deficiency than if they did not trust the ASP. As a result, ASPs need to build up strong trust with clients through all possible ways, such as enhancing their capabilities and establishing close personal relationship with managers on the client side. By these findings, ASPs could consider make corresponding adjustments in their current services and evaluate the effectiveness of their marketing strategies in terms of approaching and attracting clients

This study also offers clients a way of thinking about the adoption of an ASP. As the ASP adoption decision process is very complex, the ASP adoption decision model can help the clients to comprehensively evaluate the decision from the three perspectives without neglecting

any important perspective. Moreover, companies may have a different emphasis on some factors. This ASP adoption decision model can also assist clients to evaluate their decision. For instance, a client who may be overly concerned about cost benefits needs to carefully watch uncertainty and asset specificity of its application in order to estimate the internal production cost and hosting costs. A client who mainly focuses on strategic factors needs to consider these questions: What is the extent of IT deficiency removal (e.g., hardware, software, and IT knowledge) provided by the ASP? Can the ASP help to maintain the competitive advantages and reach the strategic goals? How important is the outsourced applications to the company? A client who values trust relationship more needs to consider: Is this ASP reliable enough? Does somebody in our company know the ASP well?

In this way, the ASP adoption decision model gives a good framework for clients to consider their evaluations in order to make a rational decision.

## **6.4 Future Research**

In addition to the aforementioned contributions of this study on ASP adoption decisions, this dissertation study opens up opportunities for future research.

First, in order to expand upon the findings and improve generalizability, the subsequent study should be conducted among a larger sample size. A large sample size with more homogenous respondents can help to discover any significant findings through a robust statistical data analysis. Particularly, in this study, the moderating effects were only marginally significant. Due to sample size, no further data analysis was conducted. Hence, a large sample with more homogenous participants is more likely to find significant interaction effects if they exist and yield more convincing interpretations.

Moreover, a large sample size with a better representation of the population can enhance the ability to generalize the findings externally. Specifically, as to current ASP clients, more surveys should be conducted among the current ASP clients of multiple ASPs across different industries and hosted applications. In this way, the findings can be more robust and generalizable.



Second, among the different types of ASPs, clients might value the significance of these decision factors differently. Future research can test this model among clients of different types of ASPs. The resulting comparison among these groups may shed more insight for ASPs to better understand clients' ASP adoption decisions.

Third, in this dynamic market, the ASP business model continues to change. With the emergence of new hosting products and new types of ASPs, many new factors might emerge and turn out to be important in this decision process. Hence, future research can be conducted to identify the new decision factors that emerge to impact ASP adoption decisions. This future research will yield a valuable and updated understanding of the current market.

Fourth, since ASPs' contracts are only two or three years long, clients frequently need to make decisions regarding contract renewal. When clients renew their contracts, other factors such as dependence or performance of ASPs will be taken into account. Thus, it would be interesting to further examine the determinants involved at the different stages of ASP adoption. A longitudinal study with a same group of customers might be a good choice.

Fifth, in this study, both surveys were conducted among private for-profit companies. Another extension is to explore the decision factors among non-profit organizations, especially government organizations. Federal, state and local governments are major clients of technology services. Hence, it may be very interesting to investigate decision factors among these organizations. It is, for instance, hypothesized that the power held by the higher-level employees over the lower-level employees will play an important role in the decision for ASP adoption.

Sixth, in this study, the ASP adoption intention of non-current ASP clients was assessed. It is also interesting to follow up with these participants to further study their actual decisions. The comparison between intention and actual behavior can give more insight to ASPs on how to turn potential clients into actual clients.

Seventh, this study only investigates some important factors from the economic, strategic and social perspectives on the ASP adoption decision. Though such an approach has proven to be effective by the empirical data, future studies can adopt other theories and take

alternative views to examine the decision. Other determinants which might be important in the decision process also could be examined in future studies.

Currently, several famous ASP players, who have a wide application hosting scope and international client bases, are willing to collaborate for these subsequent studies.

## **6.5 Conclusion**

Over the past ten years, the ASP market has experienced a rapidly growing process and played an important role in technology services. In this paper the factors that influence clients' ASP adoption decision from an integrative perspective, were investigated. The differences between the traditional outsourcing model and the current ASP business model were identified, and multiple theories from the previous literatures, such as transaction cost theory, agency cost theory, resource-based theory, resource-dependence theory and social exchange theory, were incorporated, resulting in the development of a holistic model and the formation of a series of hypotheses to test the proposed research model.

Next, the research methodology of the study was discussed. Self-administered surveys were adopted to address the research questions under investigation. It included two survey studies. The first survey study involved the collection and analysis of survey data from current clients of an ASP. The second survey study involved the collection and analysis of survey data from randomly selected top computer executives throughout the United States. The data were carefully analyzed to statistically test the proposed hypotheses. In addition, the qualitative data that related to a large university considering outsourcing an online course management application to an ASP were collected. These data were used to gain a deeper understanding of different factors under a specific context, clarify the constructs and questionnaires, and provide explanation for findings from survey studies.

Following the methodology discussion, the results of the two surveys were given. These results indicated that economic, strategic, and social factors affect clients' decision for ASP adoption individually and collectively, and that the potential moderating effects of trust on economic and social factors place trust at an important position in the whole model.

After the results were given, an in-depth discussion of the implications of these results was presented with the complements of qualitative data, followed by the discussion of study limitation. Then, the contributions of this study were addressed. This study made a contribution to both academicians and practitioners. For academicians, the model adds more to the literature on IT adoption in general and decision making of ASP adoption in particular. The ASP adoption model and its findings also add more knowledge to our understanding of clients' ASP adoption. For practitioners, the findings from this study give ASPs a better idea of clients' concerns and thus provide good guidance for their marketing and operations strategies. In other words, the findings of this study can directly help ASPs to reevaluate their business strategies in order to gain market share.

Finally, options for further research were suggested. In order to have a better representation and a deeper investigation of the factors investigated in this study, further research could be done among a larger sample size, different ASP vendors, at the different time stage, to explore the effects of different factors on ASP adoption decision.

In the current dynamic market, clients need to manage their resources in an efficient way in order to maintain their competitive strategy. The ASP business model is still a newly emerging and growing structure to deliver technology services. ASPs have to be aware of clients' requirements to provide necessary services. Hence, it is very important to understand the effect of various factors on clients' adoption decisions concerning ASPs in a comprehensive way. This study can help to extend this understanding.

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# APPENDIX A-1 QUESTIONNAIRE FOR CURRENT ASP CLIENTS



**LOUISIANA STATE UNIVERSITY AND A & M COLLEGE**  
**E. J. OURSO COLLEGE OF BUSINESS ADMINISTRATION**  
**DEPARTMENT OF INFORMATION SYSTEMS AND DECISION SCIENCES**

Dear ASP decision maker:

We are writing to ask for your help with an important and interesting study being conducted by the ASP research team in the Center for Virtual Organization and Commerce at Louisiana State University. We strive to better understand the factors that most influence a company's decision to utilize a major software application via the Internet from an Application Service Provider (ASP). Your valuable response will help to provide managerial insight into the ASP adoption decision for vendors and customers. If appropriate, please kindly forward URL of websurvey to other decision makers inside or outside of your organization.

Estimated time to complete this survey is 15-20 minutes (honest!). Please kindly take the time to complete this survey as soon as possible. All individual responses will remain confidential. We will present all data collected from this questionnaire in aggregate only. By submitting the completed survey you are indicating your willingness to participate.

As a token of gratitude, we would like to offer you a copy of the results of this survey. Just fill in your address at the end of the survey, or e-mail us, and we will send you a copy of the results.

If you have any questions or comments, please don't hesitate to contact us by e-mail or telephone. Please print out this survey and return it to us by fax or postal mail. Our contact information is:

E-mail: [asp@lsu.edu](mailto:asp@lsu.edu)  
Phone: (225) 229-7066 or (225) 578-2502  
Fax: (225) 578-2511

Postal mail:  
Chrisy Yurong Yao  
3199 CEBA Building, ISDS Dept.  
Louisiana State University  
Baton Rouge, LA 70803  
USA

Thank you very much for your kind assistance in this study.

Sincerely,

Ed Watson, Ourso Professor  
Chrisy Yurong Yao, Research Associate  
Information Systems and Decision Sciences  
Louisiana State University  
Baton Rouge, LA

# The Adoption of Application Service Providers



## E.J. Ourso College of Business Administration Information Systems and Decision Sciences Department

### Key Definitions

**Outsourcing** --- an organizational decision to turn over part or all of an organization's IS/IT functions to external vendors, but maintain resources (such as software and hardware) internally.

**Application** --- a program or set of programs that perform a set of functions in an organization, such as payroll, financial accounting, human resources, data warehousing, manufacturing, sales, inventory or communication. In this study, Internet access or network infrastructure setup is not an application.

**Application Service Provider (ASP)** --- a company that manages and delivers applications to organizations from a data center across a wide area network, e.g. the Internet.

### Current ASP Users

**If your company uses more than one application from ASPs, please answer the following questions based on the most recent ASP application project. We are trying to understand your thinking at the time you made the decision.**

What is this application? \_\_\_\_\_

How long has your firm used this application from an ASP? \_\_\_\_\_ Year(s)

What is percentage of this ASP project's budget among the whole IT investment in your firm?

☐ 0 -20 %    ☐ 21 – 40%    ☐ 41- 60 %    ☐ 61-80 %    ☐ 81-100%

### Uncertainty in Your Business Environment

**Please estimate the extent to which you could predict changes in the following factors when you made the decision:**

Very Unpredictable      Very Predictable

The overall economy/market.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Government policies or regulations impacting your organization management .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business practices needed for you to remain competitive in our industry.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer requirements/needs in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market share competition in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technology for operations and production in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supply of labor / materials in our industry.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Introduction of new products in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Requirements of an Application Service Providers

*Please state your agreement/disagreement with each of the following statements:*

#### To handle our business applications, we required that our ASP ...

Strongly Disagree      Neutral      Strongly Agree

...make a substantial investment in equipment tailored to our needs.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... make great efforts to customize software for our applications .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...possess specialized technical knowledge .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... possess specialized business knowledge .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### When we made the decision, compared to our competitors .....

... our company used more hardware platforms and multiple systems configurations. ....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... our company's software portfolio was more sophisticated/complex .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... our data processing operations were more complex.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we needed more specialized IS functions to operate our business.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Benefits of an Application Service Provider

Please state your agreement/disagreement with each of the following statements:

	Strongly Disagree		Neutral		Strongly Agree
<b><u>When we made the decision, we expected that using our ASP's services would be able to ...</u></b>					
... reduce our hardware costs .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our software costs .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our costs of hiring new information systems personnel.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our costs of training new and/or existing information systems personnel .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce the costs of modifying existing applications.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b><u>In our firm's opinion, ASP should provide other benefits as well.</u></b>					
... it is cheaper to monitor our ASP than to manage our own data processing facilities.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... it is cheaper to extend an application with our ASP than with traditional software vendors.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... it will require a minimal amount of time and effort to negotiate a contract (e.g. conditions, prices, etc.) with our ASP .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... it will cost a little to switch to another ASP .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please state your agreement/disagreement with each of the following statements:

	Strongly Disagree		Neutral		Strongly Agree
<b><u>When we made the decision, we expected our ASP could compensate our business deficiency for...</u></b>					
...our lack of IT infrastructure establishment, including necessary software and hardware .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our shortage of qualified IT professionals.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our insufficient levels of IT professionals .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our insufficient IT investment.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our lack of ability to process information in a timely manner.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our shortage of quick adaptation to industrial IT change .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our lack of ability to execute our business strategy (e.g. online transactions, system integration) ..	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Importance of the Applications from our Application Service Provider

Please state your agreement/disagreement with each of the following statements:

	Strongly Disagree		Neutral		Strongly Agree
<b><u>When we made the decision, the online applications that we expected to obtain from our ASP...</u></b>					
...provided critical functions for our business. ....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...was vital to our overall business operations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...directly impacted our daily business operations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...closely integrated with our regular business operations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...provided core business functions for our business .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...facilitated data integration throughout our whole company. ....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Our Application Service Provider's Capability

Please state your agreement/disagreement with each of the following statements:

	Strongly Disagree		Neutral		Strongly Agree
<b><u>When we made the decision, we thought that our ASP could:</u></b>					
... completely understand our business processes .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... perfectly understand our business objectives .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... clearly comprehend their roles and responsibilities in supplying our objectives.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide exact functions that we need for business operations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide clear criteria for its initial application recommendations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... assure security for data exchange and storage.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide 24/7 maintenance for our applications .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... update rented applications efficiently.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... ensure network connection for service delivery .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide good service by partnering with other software or hardware vendors.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<b>Relationship With our ASP</b>		Strongly		Strongly	
<i>Please state your agreement/disagreement with each of the following statements:</i>		Disagree	Neutral	Disagree	Agree
<b><u>Before initiating a contract relationship with our ASP, ...</u></b>					
... our ASP managers must be known to us .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our ASP must be well-known in our industry.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...we must have had social contacts with our ASP .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we must have had personal contact with the founder/CEO of our ASP .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we must have had a close personal relationship with the managers of our ASP .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Trust with an Application Service Provider</b>		Strongly		Strongly	
<b><u>When we made the decision, we believed that our ASPs could ...</u></b>		Disagree	Neutral	Disagree	Agree
...make beneficial decisions for us under any circumstances.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...provide assistance to us without exception.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...be sincere at all times. ....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...show a sincere interest in solving its customers' problem.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...provide required functions under all conditions .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...provide highly reliable services .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Uses of ASPs

<b>Now, we would like to know the <u>overall ASP uses</u> in your firm, <u>not the specific project</u>.</b> <b>No outsourcing</b> --- maintain all information systems in house <b>Outsourcing No ASP</b> --- outsource some applications to external vendors and own all resource (software/hardware) <b>Outsourcing and ASP</b> --- outsource some applications from vendors and rent some online applications from ASPs <b>ASP</b> --- only rent online business applications from ASPs <b>To what extent is your firm using an ASP for the following applications?</b>		<div style="display: flex; justify-content: space-around;"> <div>No outsourcing</div> <div>Outsourcing No ASP</div> <div>Outsourcing and ASP</div> <div>ASP</div> </div>			
A.	Financial and accounting services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B.	Production planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C.	Inventory management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D.	Human resource management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E.	Sales force automation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F.	Customer management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
G.	Supply chain management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
H.	Office automation, e.g. MS office	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I.	Collaborative systems, e.g. email systems, group systems, online conference systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J.	Business intelligences, e.g. document management, data warehouse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
K.	E-business facilities, e.g. website hosting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
L.	Training and education systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M.	Enterprise Resource Planning (ERP) Systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
N.	Others (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Please check the box which best describes the primary way in which your firm's information systems are managed and operated.</b> <input type="radio"/> We partially or totally outsource our applications to external vendors, but not ASPs. <input type="radio"/> We use ASPs for a few applications <input type="radio"/> We use ASPs for most applications					
<b>In your company, among applications that could be outsourced, what percentage of them are current ASP services?</b> <input type="radio"/> 0 -20 % <input type="radio"/> 21 – 40% <input type="radio"/> 41- 60 % <input type="radio"/> 61-80 % <input type="radio"/> 81-100%					
<b>In your company, among IT budget for applications that could be outsourced, what percent is used for ASP services?</b> <input type="radio"/> 0 -20 % <input type="radio"/> 21 – 40% <input type="radio"/> 41- 60 % <input type="radio"/> 61-80 % <input type="radio"/> 81-100%					

## Participant Information

1. Which category best describes your position within your organization during the past two years? (Check only 1)
  - ☐ Executive manager (e.g. CIO, CTO or CEO)
  - ☐ Functional manager (in sales, human resource, finance....)
  - ☐ IS/IT professional/managers (programmer, analyst, DB administration, network/communications, support, etc.)
  - ☐ Other (explain) \_\_\_\_\_
2. How many employees are in your company?
  - ☐ less than 20      ☐ 20 --- 99      ☐ 100 --- 500      ☐ More than 500
3. How many IT professionals are in your company?
  - ☐ Less than 10      ☐ 11--- 30      ☐ 31--- 50      ☐ More than 50
4. What is gross annual revenue of your company last year?
  - ☐ less than \$5million      ☐ \$5 million --- \$10 million
  - ☐ \$10.1 million --- \$20 million      ☐ \$20.1 million --- \$50 million
  - ☐ \$50.1 million --- \$100 million      ☐ \$100.1 million --- \$500 million
  - ☐ \$500.1 million --- \$1 billion      ☐ more than \$1 billion
5. Has your company had any outsourcing experiences in the past three years? ☐ Yes      ☐ No
6. Has your company ever run applications in house that you are currently renting from an ASP? ☐ Yes      ☐ No
7. Which industry is your company in?

- |  |  |
|--|--|
| <input type="radio"/> Aerospace And Defense<br><input type="radio"/> Manufacture<br><input type="radio"/> Insurance<br><input type="radio"/> Government (Fed, State, Local)<br><input type="radio"/> Education<br><input type="radio"/> Communications<br><input type="radio"/> Business Service / Consultant<br><input type="radio"/> Wholesale / Retails / Distribution<br><input type="radio"/> Marketing / Advertising / Entertainment<br><input type="radio"/> Others | <input type="radio"/> Banking/Finance/Accounting<br><input type="radio"/> Healthcare / Medical<br><input type="radio"/> Real estate / Legal<br><input type="radio"/> High Tech<br><input type="radio"/> Research / Develop Lab<br><input type="radio"/> Energy<br><input type="radio"/> Publishing / Public Relation<br><input type="radio"/> Transportation / Utilities<br><input type="radio"/> Construction/ Architecture |
|--|--|

8. What is the size of city (by population) where the headquarters of your company is located?
  - ☐ less than 10,000      ☐ 10,000 --- 49,999
  - ☐ 50,000 --- 99,999      ☐ 100,000 --- 249,999
  - ☐ 250,000 --- 499,999      ☐ 500,000 --- 999,999
  - ☐ 1,000,000 or more
9. If you have any other concern about ASP adoption, please specify below.

10. **If you would like to have a report of this study**, please provide us your email address: \_\_\_\_\_
11. Please recommend other IT decision makers who are appropriate for this survey. You can provide his/her email address below.  
 Email: \_\_\_\_\_

*Thank you for your time! Your participation is greatly appreciated.*

# APPENDIX A-2 QUESTIONNAIRE FOR NON-CURRENT ASP CLIENTS



**LOUISIANA STATE UNIVERSITY AND A & M COLLEGE**  
**E. J. OURSO COLLEGE OF BUSINESS ADMINISTRATION**  
**DEPARTMENT OF INFORMATION SYSTEMS AND DECISION SCIENCES**

Dear ASP decision maker:

We are writing to ask for your help with an important and interesting study being conducted by the ASP research team in the Center for Virtual Organization and Commerce at Louisiana State University. We strive to better understand the factors that most influence a company's decision to utilize a major software application via the Internet from an Application Service Provider (ASP). Your valuable response will help to provide managerial insight into the ASP adoption decision for vendors and customers. If appropriate, please kindly forward URL of websurvey to other decision makers inside or outside of your organization.

Estimated time to complete this survey is 15-20 minutes (honest!). Please kindly take the time to complete this survey as soon as possible. All individual responses will remain confidential. We will present all data collected from this questionnaire in aggregate only. By submitting the completed survey you are indicating your willingness to participate.

As a token of gratitude, we would like to offer you a copy of the results of this survey. Just fill in your address at the end of the survey, or e-mail us, and we will send you a copy of the results.

If you have any questions or comments, please don't hesitate to contact us by e-mail or telephone. Please print out this survey and return it to us by fax or postal mail. Our contact information is:

E-mail: [asp@lsu.edu](mailto:asp@lsu.edu)  
Phone: (225) 229-7066 or (225) 578-2502  
Fax: (225) 578-2511

Postal mail:  
Chrisy Yurong Yao  
3199 CEBA Building, ISDS Dept.  
Louisiana State University  
Baton Rouge, LA 70803  
USA

Thank you very much for your kind assistance in this study.

Sincerely,

Ed Watson, Ourso Professor  
Chrisy Yurong Yao, Research Associate  
Information Systems and Decision Sciences  
Louisiana State University  
Baton Rouge, LA

# The Adoption of Application Service Providers



## Information Systems and Decision Sciences Department E.J. Ourso College of Business Administration

### Key Definitions

**Outsourcing** --- an organizational decision to turn over part or all of an organization's IS/IT functions to external vendors, but maintain resources (such as software and hardware) internally.

**Application** --- a program or set of programs that perform a set of functions in an organization, such as payroll, financial accounting, human resources, data warehousing, manufacturing, sales, inventory or communication. In this study, Internet access or network infrastructure setup is not an application.

**Application Service Provider (ASP)** --- a company that manages and delivers applications to organizations from a data center across a wide area network, e.g. the Internet. .

### Potential ASP Users (Non-current Users)

#### Uncertainty in Our Business Environment

*First, we would like to better understand the dynamics and forces in your market. Please estimate the extent to which you can predict changes in the following factors:*

Very  
Unpredictable

Very  
Predictable

The overall economy/market.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Government policies or regulations impacting your organization management .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business practices needed for you to remain competitive in our industry.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer requirements/needs in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market share competition in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technology for operations and production in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supply of labor / materials in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Introduction of new products in our industry .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Uniqueness of our applications

*Please state your agreement/disagreement with each of the following statements:*

##### To handle our business application, we require that an ASP should...

Strongly  
Disagree

Neutral

Strongly  
Agree

...make a substantial investment in equipment tailored to our needs.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... make great efforts to customize software for our applications .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... possess specialized technical knowledge.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... possess specialized business knowledge.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

##### Compared to our competitors ...

... our company uses more hardware platforms and multiple systems configurations. ....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... our company's software portfolio is more sophisticated/complex .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... our data processing operations are more complex .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we need more specialized IS functions to operate our business.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Benefits of An Application Service Provider

##### We expect that using our ASP's services will be able to ...

Strongly  
Disagree

Neutral

Strongly  
Agree

... reduce our hardware costs .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our software costs.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our costs of hiring new information systems personnel .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce our costs of training new and/or existing information systems personnel.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... reduce the costs of modifying existing applications .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<i>Please state your agreement/disagreement with each of the following statements:</i>			
<b><u>In our firm's opinion, an ASP should provide other benefits as well...</u></b>	Strongly Disagree	Neutral	Strongly Agree
...it is cheaper to monitor our ASP than to manage our own data processing facilities.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...it is cheaper to extend an application with our ASP than with traditional software vendors .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...it will require a minimal amount of time and effort to negotiate a contract (e.g. conditions, prices, etc.) with our ASP .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...it will cost a little to switch to another ASP.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>IT Deficiency Removal</b>			
<b><u>We expect an ASP can compensate our business deficiency for...</u></b>	Strongly Disagree	Neutral	Strongly Agree
...our lack of IT infrastructure establishment, including necessary software and hardware.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our shortage of qualified IT professionals.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our insufficient levels of IT professionals .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our insufficient IT investment.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our lack of ability to process information in a timely manner .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our shortage of quick adaptation to industrial IT change.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...our lack of ability to execute our business strategy (e.g. online transactions, system integration) .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Importance of the Applications from an Application Service Providers</b>			
<i>Please state your agreement/disagreement with each of the following statements:</i>			
<b><u>The online applications that we expect to obtain from an ASP should...</u></b>	Strongly Disagree	Neutral	Strongly Agree
...provide critical functions for our business.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...be vital to our overall business operations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...directly impact our daily business operations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...closely integrate with our regular business operations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...provide core business functions for our business.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...facilitate data integration throughout our whole company.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>An Application Service Provider's Capability</b>			
<i>Please state your agreement/disagreement with each of the following statements:</i>			
<b><u>Generally, we think that ASPs in the current market can...</u></b>	Strongly Disagree	Neutral	Strongly Agree
... completely understand our business processes .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... perfectly understand our business objectives.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... clearly comprehend their roles and responsibilities in supplying our objectives.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide exact functions that we need for business operations .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide clear criteria for its initial application recommendations.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... assure security for data exchange and storage .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide 24/7 maintenance for our applications.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... update rented applications efficiently .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... ensure network connection for service delivery .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide good service by partnering with other software or hardware vendors .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Relationship With an Application Service Provider</b>			
<i>Please state your agreement/disagreement with each of the following statements:</i>			
<b><u>Before initiating a contract relationship with our ASP, ...</u></b>	Strongly Disagree	Neutral	Strongly Agree
... our ASP managers must be known to us .....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... our ASP must be well-known in our industry.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we must have had social contacts with our ASP.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we must have had personal contact with the founder/CEO of our ASP.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... we must have had a close personal relationship with the managers of our ASP.....	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Trust with an Application Service Provider		Strongly		Strongly	
Please state your agreement/disagreement with each of the following statements:		Disagree		Agree	
<b>Generally, we believe that an ASP in the current market can...</b>					
... make beneficial decisions for us under any circumstances .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide assistance to us without exception .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... be sincere at all times.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... show a sincere interest in solving its customers' problem.....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide required functions under all conditions .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... provide highly reliable services .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## ASP Uses Intention

Now, we would now like to know your <u>overall intention</u> to adopt the ASP business model for your applications		Strongly		Strongly	
Please state your agreement/disagreement with each of the following statements:		Disagree		Agree	
<b>Our firm is likely to use an ASP ...</b>					
... for our business applications .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... for most applications .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... in one or two year .....		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Do you intent to use the following applications from an ASP?</b>		<b>Yes</b>		<b>No</b>	
A. Financial and accounting services		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B. Production planning		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C. Inventory management		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D. Human resource management		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E. Sales force automation		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F. Customer management		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
G. Supply chain management		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
H. Office automation, e.g. MS office		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I. Collaborative systems, e.g. email systems, group systems, online conference systems		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J. Business intelligences, e.g. document management, data warehouse		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
K. E-business facilities, e.g. website hosting		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
L. Training and education systems		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M. Enterprise Resource Planning (ERP) Systems		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
N. Others (specify) _____		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Please check the box which best describes the primary way in which your firm's information systems <u>are likely</u> to be managed and operated.</b>					
<input type="radio"/> We only have our own internally managed, in-house data processing operations <input type="radio"/> We have an ownership holding company or parent company that provides us with computer services <input type="radio"/> We have a joint-venture computer application arrangement with other companies in our industry <input type="radio"/> We partially or totally outsource our applications to external vendors, but not ASPs. <input type="radio"/> We use ASPs for a few applications <input type="radio"/> We use ASPs for most applications					
<b>In your company, among applications that could be outsourced, what percentage of them is likely to be ASP services?</b>					
<input type="radio"/> 0 -20 % <input type="radio"/> 21 – 40% <input type="radio"/> 41- 60 % <input type="radio"/> 61-80 % <input type="radio"/> 81-100%					
<b>In your company, among IT budget for applications that could be outsourced, what percent is likely to be used for ASP services?</b>					
<input type="radio"/> 0 -20 % <input type="radio"/> 21 – 40% <input type="radio"/> 41- 60 % <input type="radio"/> 61-80 % <input type="radio"/> 81-100%					

## Participant Information

1. Which category best describes your position within your organization during the past two years? (Check only 1)
  - ☐ Executive manager (e.g. CIO, CTO or CEO)
  - ☐ Functional manager (in sales, human resource, finance....)
  - ☐ IS/IT professional/managers (programmer, analyst, DB administration, network/communications, support, etc.)
  - ☐ Other (explain) \_\_\_\_\_
2. How many employees are in your company?
  - ☐ less than 20      ☐ 20 --- 99      ☐ 100 --- 500      ☐ More than 500
3. How many IT professionals are in your company?
  - ☐ Less than 10      ☐ 11--- 30      ☐ 31--- 50      ☐ More than 50
4. What is gross annual revenue of your company last year?
  - ☐ less than \$5million      ☐ \$5 million --- \$10 million
  - ☐ \$10.1 million --- \$20 million      ☐ \$20.1 million --- \$50 million
  - ☐ \$50.1 million --- \$100 million      ☐ \$100.1 million --- \$500 million
  - ☐ \$500.1 million --- \$1 billion      ☐ more than \$1 billion
5. Has your company had any outsourcing experiences in the past three years? ☐ Yes      ☐ No
6. Has your company ever run applications in house that you are currently renting from an ASP? ☐ Yes      ☐ No
7. Which industry is your company in?
 

<input type="radio"/> Aerospace And Defense	<input type="radio"/> Banking/Finance/Accounting
<input type="radio"/> Manufacture	<input type="radio"/> Healthcare / Medical
<input type="radio"/> Insurance	<input type="radio"/> Real estate / Legal
<input type="radio"/> Government (Fed, State, Local)	<input type="radio"/> High Tech
<input type="radio"/> Education	<input type="radio"/> Research / Develop Lab
<input type="radio"/> Communications	<input type="radio"/> Energy
<input type="radio"/> Business Service / Consultant	<input type="radio"/> Publishing / Public Relation
<input type="radio"/> Wholesale / Retails / Distribution	<input type="radio"/> Transportation / Utilities
<input type="radio"/> Marketing / Advertising / Entertainment	<input type="radio"/> Construction/ Architecture
<input type="radio"/> Others	
8. What is the size of city (by population) where the headquarters of your company is located?
 

<input type="radio"/> less than 10,000	<input type="radio"/> 10,000 --- 49,999
<input type="radio"/> 50,000 --- 99,999	<input type="radio"/> 100,000 --- 249,999
<input type="radio"/> 250,000 --- 499,999	<input type="radio"/> 500,000 --- 999,999
<input type="radio"/> 1,000,000 or more	
9. If you have any other concern about ASP adoption, please specify below.

10. If you would like to have a report of this study, please provide us your email address: \_\_\_\_\_
11. Please recommend other IT decision makers who are appropriate for this survey. You can provide his/her email address below.  
 Email: \_\_\_\_\_

*Thank you for your time! Your participation is greatly appreciated.*

## **APPENDIX B EMAIL PRE-NOTICE**

From: Chrisy Yurong Yao <asp@lsu.edu>  
To: [Contact Name] <[Email]>  
Subject: The Adoption of Application Service Providers

Dear [Contact Name],

ApproSystems and the ASP research team at Louisiana State University are conducting a research project on the Adoption of Application Service Providers (ASPs). This research focuses on determining the concerns decision factors that most influence a company's decision to utilize a major software application via an on-line server from an Application Service Provider.

Within the next few days, we will e-mail you a link to the Web page for the Web-based version of the survey. When you receive the survey link, we would greatly appreciate it if you would take the time to complete it. Your valuable response will help to provide managerial insight into the ASP adoption decision for vendors and customers.

Thank you for your time and consideration. It is only with the generous help of people like you that our study can be successful.

If you have any questions about this survey, please contact Ms. Chrisy Yurong Yao or Dr. Ed Watson.

E-mail: [asp@lsu.edu](mailto:asp@lsu.edu)  
Phone: (225) 334-5067 or (225) 578-2502  
Fax: (225) 578-2511

Sincerely,

Chrisy Yurong Yao, Research Associate  
Ed Watson, Ourso Professor  
Information Systems and Decision Sciences  
Louisiana State University  
Baton Rouge, LA 70803

Matt Semrad, Chief Operating Officer  
John T. Thibodeaux, JR, CTO  
ApproSystems  
Baton Rouge, LA 70806

## APPENDIX C PRE-NOTICE POSTCARD

Dear [customer contact name],

The ASP research team at Louisiana State University is researching the most influential factors on a company's decision to use a major software application via an online server from an Application Service Provider (ASP). Within the next few days, we will mail you a paper survey with a link to a Web-based version.

We would greatly appreciate it if you would take the time to complete the survey when you receive it. Your valuable response will help provide managerial insight into ASP adoption decisions for vendors and customers. We will freely provide you the results of the survey, whether or not you are able to complete it.

It is only with the generous help of people like you that our study can be successful. If you have any questions, please e-mail or call us using the information on the other side of this card.

Sincerely,



Ed Watson, Ourso Professor  
Chrisy Yurong Yao, Research Associate  
Information Systems and Decision Sciences



Louisiana State University  
**LOUISIANA STATE UNIVERSITY**

*Chrisy Yurong Yao*

3194 CEBA Building, ISDS Dept  
Baton Rouge, LA 70803  
225/229-7066 • [asp@lsu.edu](mailto:asp@lsu.edu)

## APPENDIX D WEB SURVEY EMAIL

From: Chrisy Yurong Yao <asp@lsu.edu>  
To: [Contact Name] <[Email]>  
Subject: Survey: The Adoption of Application Service Providers

Dear [Contact Name],

We are writing to ask for your help with an important and interesting study being conducted by ApproSystems and the ASP research team in the Center for Virtual Organization and Commerce at Louisiana State University. We strive to better understand the factors that most influence a company's decision to utilize a major software application via the Internet from an Application Service Provider (ASP).

You are being asked to participate in this research based on your knowledge of online software application services. Even if your company may not currently use online applications, your input is still very valuable to us. If appropriate, please kindly forward this email with URL of websurvey to other decision makers inside or outside of your organization.

As a token of gratitude for your taking the time to complete the survey, we would like to offer you a copy of the results of this survey.

Please take the time to complete the questionnaire on the web at:

[http://cvoc.bus.lsu.edu/SS/wsb.dll/yyao1/ASPusage.htm?WSB170=\[ID\]](http://cvoc.bus.lsu.edu/SS/wsb.dll/yyao1/ASPusage.htm?WSB170=[ID])

Estimated time to complete this survey is 20-25 minutes (honest!). Your reply will be kept confidential and only summary information will be available so that no person or organization can be identified.

Please kindly complete the survey as soon as possible. If you have any question, please contact us by e-mail or telephone. If you prefer, you could print out this survey and return it by fax or postal mail. Our contact information is:

E-mail: [asp@lsu.edu](mailto:asp@lsu.edu)  
Phone: (225) 334-5067 or (225) 578-2502  
Fax: (225) 578-2511

Postal mail:

Chrisy Yurong Yao  
3199 CEBA Building, ISDS Dept.

Louisiana State University  
Baton Rouge, LA 70803

Thank you very much for your participation in this research study.

Sincerely

Chrisy Yurong Yao, Research Associate  
Ed Watson, Ourso Professor  
Information Systems and Decision Sciences  
Louisiana State University  
Baton Rouge, LA

Matt Semrad, Chief Operating Officer  
John T. Thibodeaux, JR, CTO  
ApproSystems  
Baton Rouge, LA

## **APPENDIX E EMAIL SURVEY REMINDER**

From: Chrisy Yurong Yao <asp@lsu.edu>  
To: [Contact Name] <[Email]>  
Subject: Reminder: the Adoption of ASP Survey

Dear [Contact Name],

A couple weeks ago, we sent you the link to a Web survey being conducted by ApproSystems and the Application Service Provision research team at Louisiana State University's Center for Virtual Organization and Commerce.

We have not yet received your response, and we respectfully ask that you please respond as soon as possible. So far, we have received responses from CEO, VP of lending or VP of Information Systems at various Credit Unions nationally. As an IT executive, we are sure this information would be very valuable to you in understanding how and if ASPs fit in your company's strategy. As a token of gratitude, we would like to offer you a copy of the results of this survey. Just fill in your address at the end of the survey, or e-mail us, and we will send you a copy of the results when the study is completed.

Some people have told us that they have had some technical problems in completing this survey. If this is your case, please see the instructions at the end of this e-mail. We would prefer that you complete the online (Web) version if possible, but for your convenience, you can also download a printable version of the survey from the website (or please e-mail us to request it). Please complete the survey by clicking on the following link (or copying it to a Web browser):

[http://cvoc.bus.lsu.edu/SS/wsb.dll/yyao1/ASPusage.htm?WSB170=\[ID\]](http://cvoc.bus.lsu.edu/SS/wsb.dll/yyao1/ASPusage.htm?WSB170=[ID])

Please kindly complete the survey as soon as possible. If you have any questions, please contact us by e-mail or telephone. If you prefer, you could print out this survey and return it by fax or postal mail. Our contact information is:

E-mail: [asp@lsu.edu](mailto:asp@lsu.edu)  
Phone: (225) 578-2502 or (225) 334-5067  
Fax: (225) 578-2511

Postal mail:  
Chrisy Yurong Yao  
3194 CEBA Building, ISDS Dept.  
Louisiana State University  
Baton Rouge, LA 70803

Thank you very much for your anticipated participation in this research study.

Sincerely

Chrisy Yurong Yao, Research Associate	Matt Semrad, Chief Operating Officer
Ed Watson, Ourso Professor	John T. Thibodeaux, Jr, CTO
Information Systems and Decision Sciences	ApproSystems
Louisiana State University	Baton Rouge, LA
Baton Rouge, LA	

#### TECHNICAL PROBLEMS

Some respondents have indicated that sometimes the survey server will ask you if you want to resume or delete an existing survey. Please choose "Resume", and you should be able to complete the survey with no problem. If you still experience any technical problems, please either contact us immediately or kindly send in the survey by fax or postal mail.



## APPENDIX F POSTCARD SURVEY REMINDER

Dear Computer Executive,

A few weeks ago, we sent you the survey questionnaire being conducted by the Application Service Provision research team at Louisiana State University. We have not yet received your response, and we respectfully ask that you please respond as soon as possible. So far, we have received responses from CIOs and IS managers at various companies nationally. We would like to offer you a copy of the results of this survey when the study is completed.

Please kindly take the time to complete this survey as soon as possible. You can fill in the previous questionnaire and returned it in an enclosed envelop. Or if you miss that questionnaire, you can do this in several ways:

- Web Survey (Internet): Fill in the questionnaire on the web at: **<http://projects.bus.lsu.edu/yao>**
- Paper: Download a printable version from the above website and return it at the mailing address on the back of this postcard or fax it to (225) 578-2511

Thank you very much for your anticipated participation in this research study.

Sincerely,



Ed Watson, Ourso Professor  
Chrisy Yurong Yao, Research Associate



**LOUISIANA STATE UNIVERSITY**

*Chrisy Yurong Yao*

3194 CEBA Building, ISDS Dept

Baton Rouge, LA 70803

225/229-7066 • [asp@lsu.edu](mailto:asp@lsu.edu)

# APPENDIX G INTERVIEW INSTRUMENT



LOUISIANA STATE UNIVERSITY

AND AGRICULTURAL AND MECHANICAL COLLEGE

*E. J. Ourso College of Business Administration • Department of Information Systems & Decision Sciences  
Baton Rouge • Louisiana • 70803-6316 • 225/578-2126 • fax 225/578-2511*

**Chrisy Yurong Yao • Research Associate 225/578-9070 • yyao1@lsu.edu**

## ASP Determinants Interview Outline

### I. Introduction/Consent to interview

Who we are, why we are doing interviews, how long it will take (30-45 minutes).

This research is studying determinants impacting adoption of the Application Service Providers (ASP) business model. Two specific objectives of interview: 1) understand background of your company and ASP project, and factors impacting your decisions for online application renting, 2) get your comments and suggestions on draft questionnaire, such as wording, domain coverage.

**Definition: an ASP is a company which remotely delivers applications to multiple customers from a central dataset via wide area networks.**

### II. Company Background

Contact name, company name, locations, number of employees, line(s) of business, time in business. Extent of internal IT capabilities/experience; personal IT knowledge, industrial situations [e.g. price competition, technology change]

### III. Current Status

Are you an ASP customer? If so, how long have you been a client of \_\_\_\_\_ (this ASP)?

How did you learn about ASPs in general? [e.g. from other company, conferences...]

### IV. Applications

What application/service using/going to use from an external vendor?

What are requirements for applications?

What's the role of \_\_\_\_\_ (this application) in your business?

What kind of applications do you think is important to your business? Describe its features.

### V. Determinants of ASP adoption

Can you recall the process that you went through for outsourcing \_\_\_\_\_ (this application)? [describe process, e.g., what you did first, second, & who was involved in decision process]

What are external environments impacting your decisions? [e.g.: economy change, technology change, competition]

What else factors do you consider when making decisions?

What cost considerations do you have? [e.g.: hardware, software, IT professional]

What do you expect from \_\_\_\_ (this ASP)? [e.g.: IT deficiency removal]

How did you think about \_\_\_\_ (this ASP)? [e.g.: business and technological capabilities, trust]

Did you have any relationship with the firm? [e.g.: what kind, with whom, what source, how long?]

Did you trust this ASP to provide the application you need, in which way?

#### **VI. Moderating relationship**

How does your trust with this ASP impact your other considerations? [e.g.: costs, types and scope of applications]

#### **VIII. Close**

Thank participant for time and effort. Make sure has card/contact information if wants any follow-up.

## APPENDIX H DESCRIPTIVE ANALYSIS OF ITEMS IN SURVEY ONE

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
UNCA1	83	2	7	4.22	1.362	1.855
UNCA3	83	1	6	3.06	1.374	1.887
UNCA4	83	1	6	2.99	1.311	1.719
UNCA5	83	1	7	2.99	1.235	1.524
UNCA7	83	1	6	3.11	1.148	1.317
UNCA8	83	1	6	3.43	1.171	1.371
ASS1	83	1	7	4.12	1.648	2.717
ASS2	83	1	7	4.61	1.695	2.874
ASS3	83	1	7	5.10	1.839	3.381
ASS4	83	1	7	5.23	1.684	2.837
ASS5	83	1	7	3.88	1.525	2.327
ASS6	83	1	7	3.92	1.516	2.298
ASS7	83	1	7	3.89	1.325	1.756
ASS8	83	1	7	4.22	1.465	2.148
COS2	83	1	7	5.24	1.384	1.917
COS3	83	1	7	5.48	1.282	1.643
COS4	83	2	7	5.33	1.289	1.661
COS5	83	1	7	5.41	1.362	1.855
COS6	83	1	7	5.27	1.138	1.295
COS7	83	1	7	5.16	1.320	1.743
COS8	83	1	7	4.75	1.464	2.143
DEF1	83	1	7	4.64	1.605	2.575
DEF2	83	1	7	4.64	1.589	2.526
DEF3	83	1	7	4.75	1.614	2.606
DEF4	83	1	7	4.43	1.654	2.736
DEF5	83	1	7	4.87	1.716	2.946
DEF6	83	1	7	4.84	1.770	3.134
DEF7	83	1	7	4.77	1.776	3.154
IMP1	83	2	7	5.54	1.484	2.202
IMP2	83	2	7	5.60	1.352	1.828
IMP3	83	2	7	5.83	1.238	1.532
IMP4	83	1	7	5.48	1.417	2.009
IMP5	83	1	7	5.53	1.468	2.155
CAP1	83	3	7	5.40	.949	.901
CAP2	83	3	7	5.29	1.006	1.013
CAP3	83	3	7	5.65	.930	.864
CAP4	83	3	7	5.55	.978	.957
CAP5	83	1	7	5.72	1.063	1.130
CAP6	83	4	7	6.12	.875	.766
CAP9	83	4	7	6.13	.985	.970
REL3	83	2	7	4.02	1.047	1.097
REL4	83	2	6	3.80	1.091	1.189
REL5	83	1	7	3.95	1.199	1.437
TRU1	83	2	7	4.66	1.051	1.104
TRU2	83	3	7	5.23	.967	.935
TRU3	83	4	7	5.59	.938	.879
TRU4	83	1	7	5.40	1.158	1.340
TRU5	83	4	7	5.77	1.004	1.008
APPTOTAL	83	13	31	19.25	4.126	17.021
ADPPERC	83	1	5	1.43	.814	.663
ADPBUDG	83	1	4	1.39	.778	.606

## APPENDIX I DESCRIPTIVE ANALYSIS OF ITEMS IN SURVEY TWO

	N	Minimum	Maximum	Mean	Std. Deviation
UNCA1	80	1	7	4.15	1.722
UNCA3	80	1	7	3.89	1.591
UNCA4	80	1	7	3.90	1.797
UNCA5	80	1	7	3.85	1.568
UNCA7	80	1	7	3.84	1.789
UNCA8	80	1	7	4.03	1.713
ASS1	80	1	7	3.05	1.841
ASS2	80	1	7	3.19	1.685
ASS3	80	1	7	3.16	1.932
ASS4	80	1	7	3.50	1.889
ASS5	80	1	7	4.61	1.392
ASS6	80	1	7	4.76	1.553
ASS7	80	1	7	4.62	1.496
ASS8	80	2	7	4.76	1.416
COS2	80	1	7	4.76	1.723
COS3	80	1	7	4.91	1.511
COS4	80	1	7	4.93	1.339
COS5	80	1	7	4.96	1.739
COS6	80	1	7	5.00	1.714
COS7	80	1	7	4.95	1.590
COS8	80	1	7	4.87	1.538
DEF1	80	1	7	4.20	1.951
DEF2	80	1	7	4.28	2.074
DEF3	80	1	7	4.55	1.895
DEF4	80	1	7	4.40	1.893
DEF5	80	1	7	4.18	1.979
DEF6	80	1	7	4.36	1.891
DEF7	80	1	7	4.15	1.930
IMP1	80	1	7	4.55	1.457
IMP2	80	1	7	4.31	1.463
IMP3	80	1	7	4.40	1.498
IMP4	80	1	7	4.37	1.344
IMP5	80	1	7	4.38	1.513
CAP1	80	1	7	4.38	1.878
CAP2	80	1	7	4.40	1.811
CAP3	80	1	7	4.71	1.780
CAP4	80	1	7	4.51	1.800
CAP5	80	1	7	4.69	1.658
CAP6	80	1	7	5.09	1.850
CAP9	80	1	7	5.07	1.914
REL3	80	1	7	4.15	1.700
REL4	80	1	7	4.16	1.618
REL5	80	1	7	4.26	1.756
TRU1	80	1	7	3.56	1.637
TRU2	80	1	7	3.73	1.583
TRU3	80	1	7	3.51	1.493
TRU4	80	1	7	3.79	1.524
TRU5	80	1	7	3.55	1.542
ADPGEN	80	1	7	3.91	1.752
ADPMOST	80	1	6	3.16	1.610
ADPTIME	80	1	7	3.63	1.789
APPTOTAL	80	0	13	5.37	4.011
ADPPERC	80	1	4	1.49	.595
ADPBUDG	80	1	4	1.44	.613

## **APPENDIX J CASE INTERVIEWS**

In this appendix, the data analysis and results of case interviews are presented. First, the background information of the project is described. The data collected from case interviews are analyzed, and then the final results and findings are provided according to the structure proposed in the ASP adoption decision model.

### **1.1 Background Information**

#### **1.1.1 Background of University**

This large public university is located in the capital city of a southern state. Since 1860, this university has served the people of the state, the nation, and the world through extensive, multipurpose programs encompassing instruction, research, and public service. Currently, it has a community of more than 34,000 faculty, staff, and students from all of the 50 states in the United States and from more than 120 countries. Of the more than 34,000 people in the university community, more than 31,500 are students from diverse ethnic and religious backgrounds.

Each year the university conducts a fall semester, a spring semester, a summer term consisting of one or more sessions, and a three-week intersession between the spring semester and summer term. Usually, enrollment peaks in the fall semester at more than 31,000 students and drops by about 8 percent in the spring. The summer term enrollment totals about 11,500.

Despite its large enrollment, the university maintains an impressive record of small-class teaching. Two-thirds of the classes offered in any semester have fewer than 30 students and fewer than 6 percent of all classes have 100 or more students. Moreover, the university has over 1400 full-time and part-time faculty members. The overall student-faculty ratio is 20:1.

The university offers a variety of degree plans, including: bachelor's degrees in 71 major fields, master's degrees in 75 major fields, and doctoral degrees in 54 major fields. Among these degree plans, a great number and variety of courses are offered. These courses are generally taken by traditional students. However, the university also serves nontraditional

students, people whose educational needs cannot be met through full-time residential college study, in the following ways: Evening School, a nighttime degree program for part-time adult students; distance learning methods, such as correspondence study and distance learning, to extend its resources to meet special requirements; and credit and non-credit courses offered at on- and off-campus locations to people with various backgrounds and unique learning objectives.

### **1.1.2 Web-based Course Management Application Usage**

With the mission of generation, preservation, and dissemination of knowledge, the university is very active in providing advanced facilities for teaching and in encouraging any attempts to improve teaching.

As early as 1998, some faculty members in the business school had been trying to develop a template for web teaching. The initial in-house system was hard for faculty members to use, as they had to learn how to develop the web pages by themselves. After course management software from the Blackboard system was made known through a conference, they started to explore different course management software. Eventually, in the summer of 1999, in order to determine its effectiveness as a packaged courseware management system, Blackboard was introduced to the school as a pilot project. Three university organizations were involved in beginning this project: The Design School, The Centers for Excellence in Learning and Teaching (CELT), and the E.J. Ourso College of Business Administration (CBA). The software license was purchased by professors in the Design School for their own purposes. CELT invested money in servers. CBA housed and supported the application.

When the project started, the Blackboard application only served 2 or 3 people in the Design School, 5 to 10 people at CELT, and 20 to 30 people at CBA. The Technical Group at CBA monitored and supported the application and services. The responsibility of CELT was to provide users training. With this kind of coordination, it worked very well for a year or two. However, as more and more faculty members became aware of the application and started to use it, the demand for services exceeded the capability of the server and supporting efforts which could be offered by the original coordination groups. By the spring semester of 2000, the number of users had doubled to 80 people, so the demands of maintenance and support required for Blackboard increased. Hence, in spring 2001, after the purchase of an updated software license,

the maintenance and support of this software was transferred to the Office of Computing Service (OCS). OCS assigned a special group of people and two dedicated servers to host Blackboard applications. In the summer of 2001, OCS installed two Blackboard servers, one performing as a primary server and the second acting as a backup server. In the beginning of fall 2001, OCS had 416 courses with nearly 12,000 enrolled students accessing the primary Blackboard server.

Since fall 2001, the usage demand for the Blackboard application has continued to grow. In the spring semester of 2003, there were about 773 courses with 21,021 enrolled students using this application. At that time, facing such a large number of users, OCS could not provide quality service any longer and requested that the university consider a better solution for providing this service. Thus, a decision committee was formed to evaluate the in-house hosting and an external outsourcing solution, and to make a final recommendation.

Another thing that deserved noticing was that OCS simultaneously hosted an internally developed web course management system, Semester Book, which had similar functions to those of Blackboard. Semester Book had been developed since 1998 by OCS and has served the whole university.

### **1.1.3 Background Information about the ASP --- Blackboard Inc.**

Blackboard Inc. was founded in 1997 by two consultants and a student-faculty team at Cornell University in Washington, D.C. It has the vision to transform the Internet into a powerful environment for the educational experience. Blackboard offers several types of enterprise software products and services that power e-Education programs in several segments, including Higher Education, K-12 Education, Corporate/Government and International Training. Blackboard delivers solutions for online teaching and learning, campus communities, campus commerce services, and the integration of Web-enabled student services and back office systems. It also partners with industry experts to create a network of solutions that enhance the online educational experience for institutions, administrators, instructors, and students. Currently, Blackboard Inc. has more than 400 professionals. It is a leading enterprise software company for e-Education in the current market, serving more than 2,300 clients in more than 100 countries (Blackboard, 2003).



For higher education, Blackboard Inc. provides various systems to advance educational outcomes and meet increased constituent expectations, including a learning system, a content system, a portal system, and a transaction system (Blackboard, 2003). The university under this study has been using Blackboard's learning system, an enterprise-critical online environment used to supplement either traditional or pure distance learning, since the pilot project in the summer of 1999.

Blackboard Inc provides online applications to customers. As the system host, Blackboard Inc. has created a URL associated with the system for a university. By using this URL, faculty and students in the university can use a pre-assigned user name and password to login the system hosted by Blackboard Inc. (See Figures 1 to 3). The principal features of this learning system include (Blackboard, 2003):

Course content management and content sharing (See Figure 2)

- A re-architected assessment management system designed to improve assessment creation workflow
- New functionality which allows instructors to electronically manage the collection and organization of assignments (See Figure 3)
- Discussion boards and a new Virtual Classroom tool which enables dynamic collaboration and communication in the learning environment
- A robust enterprise system administration which enables institutions to successfully manage system growth by reducing administrative overhead
- Data management for integration with student information, identity management, and authentication systems

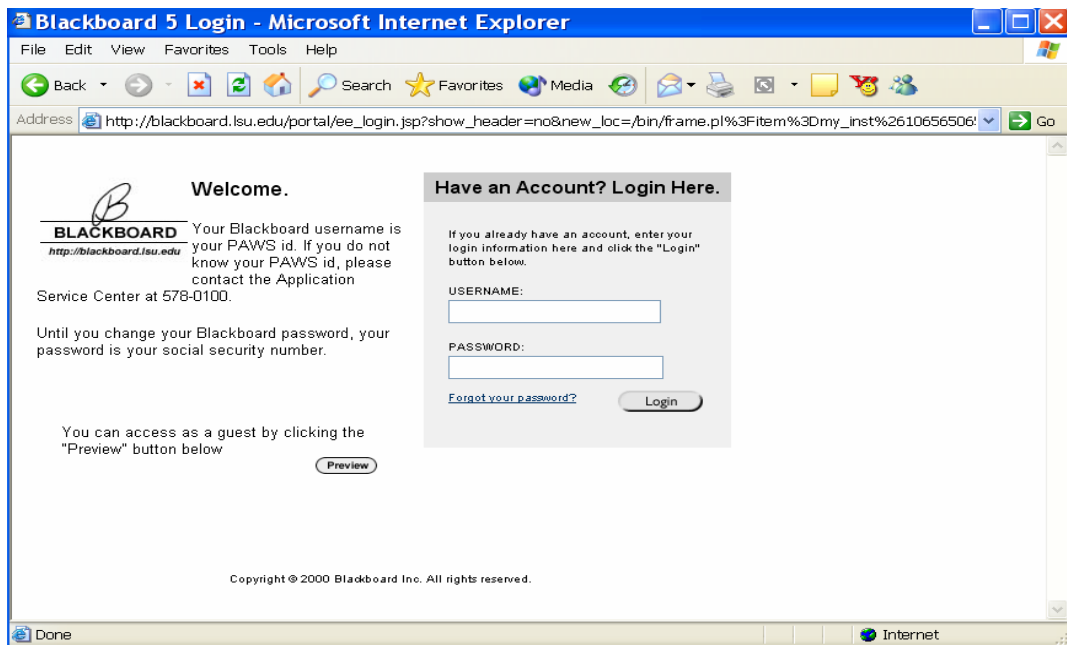


Figure 1 Blackboard Login Screen

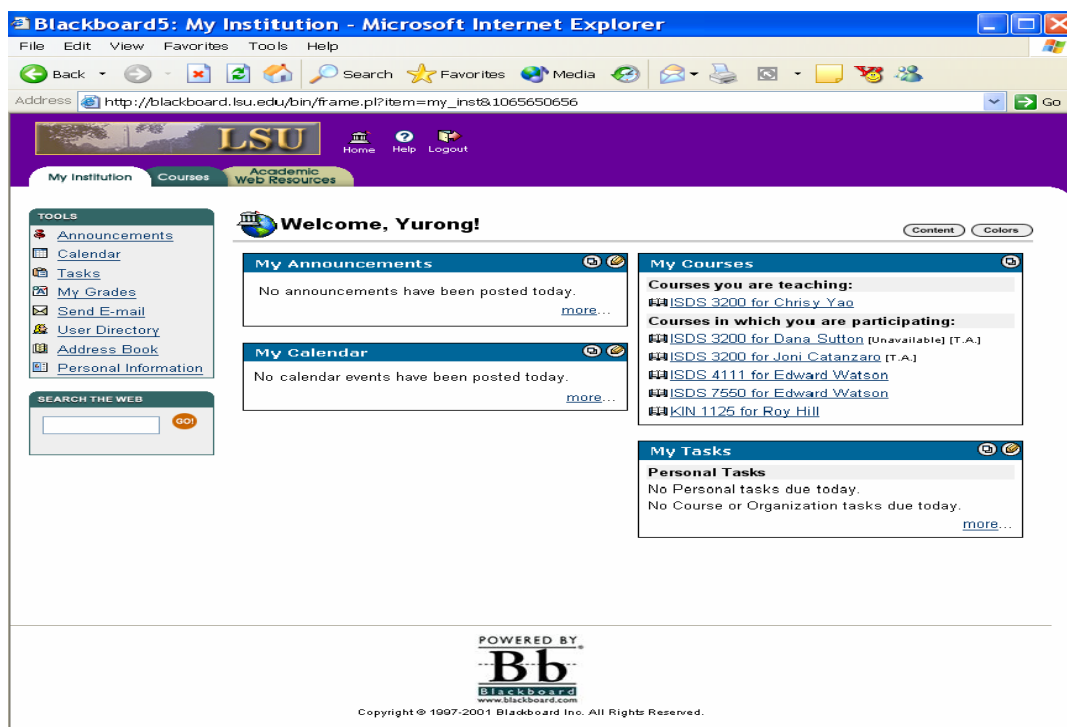
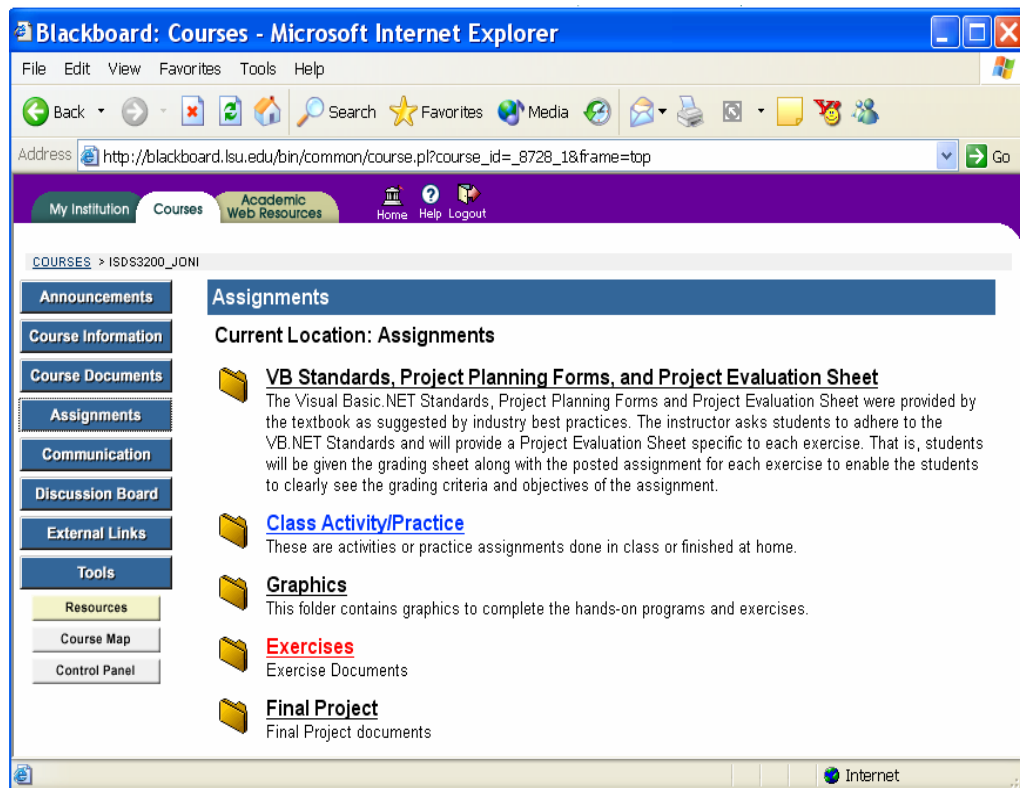


Figure 2 Course Management of an Individual Student



**Figure 3 Course Management for an Individual Course**

For almost three years, the university had managed this online learning system in-house. The university was able to bear this responsibility until user demand increased to the extent that the university could no longer support the system adequately using the resources they had. However, as a large number of users were relying on this system for teaching and learning, and most faculty members were satisfied with its functionalities, it was difficult to stop supporting this system. So it was necessary for the university to find a way to continue to use this system in the most efficient, cost-effective way. The two choices seemed either to host the system in-house by enhancing IT capabilities or to outsource the system to an external ASP. Various factors had to be considered in order for the university to make a rational decision on this issue.

#### **1.1.4 Background Information about Participants**

In order to understand the factors influencing the university's decision on this ASP adoption project, five personal interviews with decision makers (henceforth cited as informants)

involved in this ASP project were conducted. The detailed process of the interviews and data analysis process are presented in Chapter 4.

Here, background information about the informants is further introduced. With the help of the professors in my dissertation committee, two key decision makers were identified first. These decision makers further helped to identify the other two decision makers in their decision committee. Thus, four of them had participated in the interviews.

Among these informants, two were IS professionals from the OCS. They were the only persons directly in charge of Blackboard application usage and hosting. The other two were from the university management administration: one was Director of CELT and the other was the provost in charge of this course management application. In the decision committee, two informants from the OCS provided detailed reports to address the feasibility of internal maintenance and external hosting and compare pros and cons of each approach. The informants at the administrative level took consideration more from the whole university for the final decision.

Moreover, in order to gain a full picture about the usage of this course management system in the university and the system itself, the professor who initially started the Blackboard trial project in the College of Business Administration was also interviewed. He was very familiar with the course management project and exchanged ideas with university administrators.

Thus, these informants understood the various factors embedded in this decision. They were qualified to participate in this case study. Their opinions helped to investigate the impacts of different factors from three perspectives on the ASP adoption decision.

## **1.2 Findings**

In this section, findings from these five interviews are presented according to the major factors that were discovered in the data analysis. The factors which were previously theorized to affect customers' decisions are discussed first, followed by the presentation of a newly discovered factor. The key findings are summarized in Table 1.

**Table 1 Summary of Factors Impacting ASP adoption Decision in the University**

<b>Factors</b>	<b>Findings</b>
<b>Economic Factors</b>	
Uncertainty	<ul style="list-style-type: none"> <li>• Unpredictable user demands required input of hardware, software, and IT professionals in order to manage.</li> <li>• Changed user requirements increased internal hosting costs.</li> <li>• Economic and technical changes did not significantly impact costs and decision.</li> </ul>
Asset Specificity	<ul style="list-style-type: none"> <li>• University asked for standard applications, not many customization requirements.</li> <li>• University had a few requirements for function improvement</li> <li>• Standard requirements reduced hosting fees and set-up fees</li> </ul>
Cost Benefits	<ul style="list-style-type: none"> <li>• High internal hosting costs: investment in hardware, software and IT professionals</li> <li>• Relatively low external costs: low monitoring and negotiation costs</li> <li>• Significant cost benefits associated with outsourcing</li> </ul>
<b>Social Factors</b>	
ASPs' Capability	<ul style="list-style-type: none"> <li>• The university required vendor to have a good understanding of business requirements and was satisfied with functionality of the system and interface design</li> <li>• The university required high reliability in application delivery, reliable support services, data storage and transferring</li> <li>• The university acquired evidence for Blackboard's capability from multiple sources: trade show, other schools' reference, on-site demo.</li> <li>• Blackboard provided added-on applications with this system</li> </ul>
Social and Personal Relationship	<ul style="list-style-type: none"> <li>• The university had contacted Blackboard many times at conferences, trade shows, and trial usage.</li> <li>• Decision makers at the university knew persons at Blackboard well, including managers and company representatives.</li> <li>• The university had only a business relationship with Blackboard, no close personal relationship.</li> </ul>
Trust	<ul style="list-style-type: none"> <li>• The university required high trust on Blackboard before it decided to outsource this application</li> <li>• The university was highly satisfied with this system</li> <li>• The university believed that Blackboard had the intention to provide good services</li> </ul>
<b>Strategic Factors</b>	
Application Importance	<ul style="list-style-type: none"> <li>• Online course management was a critical system to the university</li> <li>• Careful investigation was required for this outsourcing decision</li> </ul>
IT deficiency Removal	<ul style="list-style-type: none"> <li>• Complement capital investment shortage in hardware, software license</li> <li>• Complement internal IT professionals shortage</li> <li>• Complement the lack of specific knowledge in implementation and maintenance of the system</li> </ul>
<b>Moderating Relationship</b>	
Trust and economic factors	<ul style="list-style-type: none"> <li>• The university would go with Blackboard they trust, not the cheapest ASP.</li> </ul>
Trust and strategic factors	<ul style="list-style-type: none"> <li>• The university can only outsource important applications to a trustable vendor</li> <li>• As Blackboard is a trustable vendor, the university can allow it to be involved more in the university and remove more deficiencies</li> </ul>
<b>New Factor</b>	
Internal Parallel Systems	<ul style="list-style-type: none"> <li>• Necessity of maintaining two systems with similar functions</li> </ul>

## **1.2.1 Economic Factors**

### **1.2.1.1 Uncertainty**

Although the techniques used for web-enabled teaching have evolved dramatically during recent years, technical change was not cited as a significant factor impacting the decision to outsource. This finding may be due to the fact that before the exploration of Blackboard's software package, the university's Office of Computing Services (OCS) already had considered all the functions associated with web-teaching and had developed a Lotus Notes-based course menu system, named Semester Book, which had similar functionalities to those of the Blackboard system. Hence the university was in a good position to predict pretty accurately any changes in technology.

“Technology is not a big issue, because we all had those functions from the first day. [Blackboard] got them and improved them. But I do not see any technology out there to revolutionize this application...”  
[Informant at OCS]

“Those guys in computer service were working very hard with systems. They had to create essentially what is available as a product out there. The Semester Book is based on Lotus Notes systems. It has similar functions to Blackboard”. [Informant at CELT]

Moreover, it was also found that external changes in the economy and the education industry did not have a significant influence on the decision of ASP adoption. Compared to companies in other industries, universities are in a relatively stable environment. Particularly as a flagship university in this southern state, even when the economy was bad, the university consistently got substantial funding from various sources in technology and research.

“The schools and departments have funding from many different places. The university has the technology fee from students' tuition. But it is just one part of the total technical investment. There are many other ways to get money in technology.” [Informant at CBA]

“[In] recent years, our budget is a little tight, but this impact is not that serious.” [Informant at University Administration]

However, the unexpected change in the number of users of Blackboard applications was found to exert pressure on OCS to the extent that OCS was not able to provide required services for technological usage.

“The usage of the Blackboard application increased very quickly. During the past two years, the users of Blackboard nearly doubled. In the Fall semester of 2001 we had 416 courses and 11,910 students. In the spring semester of 2003, we had 773 courses and 21,021 students accessing Blackboard. We needed more servers and people to run the application”.  
[Informant at OCS]

Actually, it was found that the demand increase happened in the pilot stage, too. After the first semester’s operation, the number of users doubled from 40 to 80 immediately. At that time, they also did not predict such a big jump, which caused the problem for them to host it well.

“That first semester, we had about 40 users....Then, the next semester the number was doubled to around 80. In year 2000, it was just growing. We probably had 60 to 70 people in the Business College using it. [CELT] had 35 to 40, [Design School] over there has few of his people....We ran into several issues [for such a large number of users].”  
[Informant at CBA]

Moreover, the increase of users in accessing Blackboard applications required more investment in software, hardware, and IT professionals, which significantly increased the costs of internal Blackboard applications hosting. As a result, it became hard to host everything in-house, compared to outsourcing applications to Blackboard Inc

“As the usage is increasing so quickly, the extended enterprise edition applications need at least 8 more servers to run. Thus, the university has to buy more computer servers. It is a huge amount of money. Also, if we buy more servers, they would need to hire more IT professionals to maintain these servers and run the applications”. [Informant at OCS]

“Blackboard can increase their service scale very quickly. We have the flexibility to use as much as we want. It can solve our problem right now.” [Informant in University Administration]

Hence, in this case, changed demands on online course management systems resulted in increasing the cost of in-house application hosting, which in turn made the university carefully consider external outsourcing as a possible solution to its hosting problem.

#### **1.2.1.2 Asset Specificity**

It was found that the university used standard applications from Blackboard.

“Blackboard provides a standard software product to their customers. There is not much customization work.” [Informant at OSC]

“I do not think we ask for customization. Basically, we take the standard version of Blackboard.... [though] we try to work with them to see whether it can be improved in some way. More generally, for example, assessment portion, online exam that sort of thing.” [Informant in University Administration]

“To my knowledge, we do not have any special customization requirements. The original basic version of software can satisfy our needs. It is not the issue only associated with our university. They have to provide applications good for all the university. The functions are pretty much the same.” [Informant at CELT]

Asset specificity was found to be an important factor impacting cost considerations. In other words, the standardness of the Blackboard application changed the university's consideration of costs to the extent that the university was willing to adopt Blackboard's standard version of their online course management system.

“[Office of Computing Service] tried to make [Blackboard] systems seamless with our administration system. What we learned [was] that it could be done. But the source code is primary information of Blackboard Company. They would not give it away. Rather, they would require the university to hire their members to work with hours at a very considerable amount of money to integrate applications to make blackboard functions as seamlessly as Semester Book [does]....The question to make that investment was kicked ...at least a year. Do we really need this money to do this customization? ... Standard application can not do it, but it is cheaper... [Hence] we go for standard systems.” [Informant at CELT]



“[Customization] will take more time and increase costs. [Blackboard] got to charge you a lot. Thus, we stay with standard one... and we are satisfied with the current functions.” [Informant at OCS]

It was also found that since this standard package gave the university more flexibility and alternatives for the future, switching cost was an insignificant factor.

“I do not think there are a lot of differences [between different software packages], because all of them have to stay in the market with the competitors. Basically, they have to be at the same level. So the applications and features would be very similar. It is not hard for us to find another vendor.” [Informant in University Administration]

“We have thought about [in-house hosting after several years]. If in some future days, due to whatever reasons, we will prefer to maintain technical support and user account on campus.....for this standard application, we can do it.” [Informant at CELT]

Thus, it was cited that standard packages did not cost the university more than in-house development.

“Computing service was trying to make everything in-house. It was very difficult. Blackboard is cheap. You buy [a] one-year server license. That means you can run as many people you want in one server for about 5000 dollars. That’s the total cost in the beginning. It’s still cheap, if we have \$ 100,000 for having the complete application. If you have everything Blackboard says they can do, it can almost replace Paws [an internal portal system].” [Informant at CBA]

“You are right. We only got the standard license from Blackboard. It is not cheap. But we do not need to buy more servers and get more people only for this system. In that sense, this license and usage fees are cheap.” [Informant in University Administration]

Hence, standard applications reduced the outsourcing costs and provided more alternative opportunities, and thus helped the university to gain more confidence in outsourcing.

### **1.2.1.3 Cost Benefits**

Cost benefit was significantly emphasized by the informants as a factor directly impacting the outsourcing decision. The university had to think about whether the outsourcing

solution would be affordable in the next few years. Therefore, cost was taken as a very serious consideration in making the decision.

“[Cost] was significant, though there are others. It’s a significant amount of money every year. That has been paid every year. And obviously, the university can not make the decision to head in that direction, if in a year or two, we can’t afford that application. Because all the structures, commitments, courses, planning should be there. It’s the decision...once we made [it,] we have to stay with [it].” [Informant at CELT]

In this case, it was found that the essential reason for outsourcing was the difficulty in dealing with increasing internal hosting costs, such as the high investment in hardware, software and IT professionals. All these production costs were caused by the sky rocketing demand on usage.

“Extended enterprise edition applications need at least 8 more servers to run. The university has to buy more computer servers. It is a huge amount of money. Even [if] we would buy more servers; we still need more IT professionals to run these servers.” [Informant at OCS]

“For one thing, if we are doing it on campus, we require additional hardware. It will require personnel who are currently deployed to other responsibilities. It probably means that you have to hire more personnel. So you are...considering additional hardware costs, personnel costs.” [Informant in University Administration]

“If we would host everything inside, we have to train our IT professionals. That needs a lot of time and money. Still, they may not know as much as Blackboard does..... ” [Informant at OCS]

“The version and license level of Blackboard we are currently using can not afford the number of accounts and students we serve now. We should be at level 5.5, version 6 for enterprise. But we are using a lower version which is only designed to support 5000 students. Now we are running almost about 50,000 student IDs. The cost to get the version we really need to do this probably and to get the hardware, using multiple servers, not one machine, has become a problem. Most recently, we have found a way to address [this problem]... [--what] we are actually to do instead of buying machines and working in campus... [is] outsourcing.” [Informant at CELT]

These informants all thought that the cost of the needed hardware and IT professionals could be covered by Blackboard when the university outsourced their applications. Moreover, the administrative cost associated with outsourcing was also considered controllable.

“There [are not] many administration and monitoring fees involved in the applications, as the contract will have clear items to indicate penalty for...[non] delivery of quality services. We do not need to spend a lot of time on service administration. As updating costs are included in [the] yearly license fee, hosting can save updating fees as well. Applications upgrade will be done by either Blackboard or the university without additional costs. Regarding...contract negotiation, OCS and [the] purchasing department will work hand in hand to set up [a] contract. Most of [the] negotiation work will be done by [the] purchasing department. That is not a large amount of work.” [Informant at OCS]

Unfortunately, due to confidential issues, it was impossible to know the exact costs benefits. However, purchasing officials in the accounting office confirmed that it was cost-effective compared with internal hosting.

Thus, overall, most informants considered that outsourcing this application externally was an economical solution. It was cited that, compared with internal hosting, Blackboard could provide the application in an economical way.

“We got the level-I license, and then we have to move to level-III license. That is the license for the software. The contract is for the license and hosting fees. [Blackboard] charges us monthly based on the users. They charged the number of unique users. That’s how the cost can be figured out. If we host it, we have to buy a lot of hardware. If you consider the salary of the people we hire to run the software, in my opinion, it is the same or less.”[Informant at OCS]

“If you consider all hidden costs, I think it would be more economical. You know, to have an expert out there, who knows all the problems and can find the solutions for them as opposed [to] us try[ing] to sit here and be our own doctor. So I think the trend is for institutions to do outsourcing.” [Informant in University Administration]

“In my mind, it’s cheap compared to having somebody on staff trying to do that, develop that or teach people how to do it.” [Informant at CBA]

Hence, as a solution to the high demand in usage, outsourcing offered a large amount of cost benefits, and actually turned out to be cheaper than in-house hosting with its high internal development and support costs.

## **1.2.2 Social Factors**

### **1.2.2.1 ASP's Capability**

Blackboard's capability in delivering good course management applications was cited as an important factor to attract the university to use its ASP solution. It was found that most informants agreed that Blackboard had the expertise to provide quality course management software, which was able to satisfy the requirements of its customers.

“They provide good software. It is suitable for most universities in the services. Its functions can satisfy our needs...[for] online teaching.”  
[Informant at OCS]

“We went with Blackboard over WebCT (another provider), primarily because [Blackboard is] user friendly. Faculty found out that Blackboard is user friendly.” [Informant in University Administration]

“The level three version [system] of Blackboard...it can almost replace Paws (an internally developed community system). It is a portal. You get in and you can have the community, a kind like Paws does.”  
[Informant at CBA]

In addition, it was found that informants argued that Blackboard was able to offer good services and technical support for its customers.

“They promise 24\*7 supports and 99% network connection.”  
[Informant at OCS]

“They provide [a] service base. If any problem comes out, like [the] server going down, or some strange problems, they have a help desk. You can call and they give you 24/7 services. Plus they keep you up-to-date on whatever the newest additions are to enhance the program. They will come to the institutions and help you with some training, if you want to. The last thing you did is to learn intelligences.” [Informant in University Administration]

It was also found that information from other sources including a “shoot out” among software providers, a campus computing survey, and a state-wide survey, became good supporting evidence for Blackboard’s capabilities.

“There were at least two events. Blackboard and other providers for the similar products were all invited. They called [it a] “shoot out”. They put products one next to another. Everybody can walk in and try to make a break. At the end, the Blackboard was the choice among all the representative[s] of the universities in the state. There [are] still some questions and concerns remaining, but there is almost total agreement that it is the most favorable product.” [Informant at CELT]

“[The state agent] brought the companies in. They called it... [a] “shoot out”, where they can display their products and people can ask the questions.... [The results] came out as Blackboard #1 and Web CT #2.” [Informant in University Administration]

“[The] State of Louisiana has gathered all representatives together to decide which software will be suitable for online education. Blackboard turned out to be [the] software accepted by all the schools.” [Informant at OCS]

“... And also you know there is a Kinogreen [issue that] does a campus computing survey every year. So keeping up [with] those literatures and reading the journals, we found that a lot of institutions are going with the same two systems [Blackboard and Web CT].” [Informant in University Administration]

“... [The] board of regent again did a survey across the state. Our state chose Blackboard.” [Informant in University Administration]

Furthermore, it was found that with the expertise in course management systems, Blackboard’s applications were considered to have advantages over internally developed systems. These advantages were shown at the beginning of the university’s Blackboard usage.

“[The course] is directly online from Blackboard. Blackboard hosts the course for individual faculty. The Office of Computing Service simultaneously develops lotus notes-based course menu system that is [called] Semester Book. Both serve the same purpose, but each one has ...[its] different advantages. The faculty [that] used Blackboard found [that]

it's friendlier. Though the features are similar, the interface [for Blackboard] is friendlier." [Informant at CELT]

"At that time, Semester Book has the similar functions, but it was hard to use." [Informant at CBA]

Besides their principal course management applications, other usable functions suitable for university operations were offered by Blackboard as an add-on to the course management software. It was found that these additional functions added weight to Blackboard's capability when the university considered the outsourcing decision.

"[Blackboard] has bought a number of other small companies and diversified their products to include features and services that did not directly relate with course websites. They bought the largest, or second largest company, that provides POS (point of sales). Thus, they are able to provide student ID card[s] to the university." [Informant at CELT]

"[Including ID card functions], there is collection [of systems ranging] from a web course system to a very complex system. Blackboard [company] has a large ... [scope]... of campus systems." [Informant at CELT]

Furthermore, it was found that faculty members in the university were satisfied with the functions provided by Blackboard and trusted their ability in providing the services.

"We did a faculty survey, and we put out about eight different course management systems and let the faculty look at them, work with them and tell us which ones they liked best. And the two top choices were Blackboard #1 and Web CT #2." [Informant in University Administration]

"We are satisfied with the services provided by Blackboard. Every time, when we have problems, they can give a helpful and effective support on the system. We have no problem with their services." [Informant at OCS]

To sum up, capability was regarded as an important factor influencing the university's outsourcing decision. Hence, the university did a lot of work to confirm the quality of Blackboard's software and service, in order to enhance their confidence in Blackboard and its

products. This confirming work formed the basis for the university to make the rational decision to go with the ASP solution.

#### **1.2.2.2 Social and Personal Relationship**

Social relationship was cited as a useful channel to help the university build trust in Blackboard. It was found that Blackboard actively was seeking opportunities for public exposure so that their potential customers would be aware of their company and perhaps even become acquainted with their products and services.

“On a more direct basis, Blackboard over the [last] two or three years has been invited to conferences and events. They came down as an exhibitor [in] a trade show type of deal, or professional technology conference that we and others...sponsored for the states. Sometimes, they came to universities. They do it around the country. They call it ‘Blackboard Day’.... [In] the year they did it in Louisiana, they did it in the University of New Orleans and invited all the universities in the state. Yeah, that was a marketing deal. The program they put together actually showed how [the application] was used and [how it] exchanged information... [That program] convinced faculty members in the state to use [the application].”  
[Informant at CELT]

“We had the representatives come to the campus and tell us about the new improved version and how it will help us to do more than we do now. ....They were willing to come to do conferences and seminars and let themselves...be charged.” [Informant in University Administration]

“Blackboard has a national-wide reputation in providing software for the education industry.” [Informant at OCS]

“Blackboard is an outstanding company in this market. We have heard about their name for quite a long time.” [Informant at University Administration]

It was also found that the university gained understanding about Blackboard’s software and capabilities through different channels, such as references from other universities that were using the applications, a trade show, Blackboard demos given in the university, and the university’s nearly three-year use of the earlier version of this course management system. Through these channels, the university had more opportunity to gain confidence in this ASP.

“This campus did a lot of digging to find out who else are using this application. We have to find out what positive and negative observations they have....” [Informant at CELT]

“Since we first knew Blackboard, we have met many times in different events or conferences. Little by little, we have known it very well. We feel comfortable to use their software.” [Informant in University Administration]

“We have a long-term relationship with Blackboard since 1998. We are confident with their software and services.” [Informant at OCS]

However, it was also found that although these decision makers were familiar with the representatives or managers at Blackboard, the personal relationships among the leadership of the two parties was not considered to be an important factor in the ASP adoption decision.

“Blackboard has a representative for each school. In one region, there is a regional representative. Only two administrators in our university can contact representatives. But we only have [a] business relationship with these representatives. We only contact these guys for Blackboard services.” [Informant at OCS]

“We know their managers personally, but ...the relationship is at the professional level. The Blackboard folks certainly would like to have an influence more than they did.... In the end, we think we have to meet the needs of our students and faculty. If the decision is not made in our best interest, then the personal relationship does not matter.” [Informant at CELT]

“As far as I know, there is nobody having the [a] special personal relationship with [Blackboard].” [Informant in University Administration]

Hence, in this case, social relationship between the two parties, through various sources, initiated and enhanced mutual understanding and further built the university’s trust in Blackboard’s applications. However, personal relationships were said not to influence the university’s decisions. Nevertheless, the informants did acknowledge that personal relationship could increase their trust in Blackboard.

“It is human nature to have more trust..., [when we have more personal contacts]...” [Informant at CELT]



### 1.2.2.3 Trust

It was found that trust in Blackboard was considered as an essential and basic condition for the university to make the ASP adoption decision.

“You have to have a higher level of trust that they can do as good a job as we would do...for ourselves...” [Informant in University Administration]

“That is why we have to investigate their capabilities to make sure that we feel comfortable with them....Some of our questions have to do with “Show us, who are some of your clients that have the similar requirements as we have. Give us some references.” [Informant at CELT]

The university also emphasized that Blackboard had the intention to provide a good service.

“I think we are probably about satisfied with what we get, at least from users’ satisfaction. When we have some questions, they come to the campus to talk with our staff members from computing service and home office. We sat in the conference and gave them hard questions. They gave us better answers”. [Informant at CELT]

It was also found that based on the current working experiences and various resources, the informants showed strong trust in Blackboard when they considered it as a good candidate for ASP adoption.

“By working with Blackboard, we have known about their capabilities. We believe Blackboard can do a good job.” [Informant at OCS]

“We feel very secure for the same reason I said some time ago. We feel like if anything goes wrong, we can get instant help. And it’s delivered by specialists in the field, who know what they are doing. So we are not bumped around here for two or three weeks...try[ing] to figure out what is wrong, because...[we have] got to keep...[the system] up and running.” [Informant at University Administration]

“Now, if I didn’t know anything about the company, and we hadn’t had that experience [that] we had, then we would not have that security....With Blackboard, we feel very secure.” [Informant at CELT]

“We did the survey among our faculty, and they are satisfied with Blackboard applications.” [Informant in University Administration]

Hence, it was found that in this case, trust played an important role in helping the university to make a rational decision. In other words, high trust was required for the university to go with the ASP solution, and the decision committee made great efforts to investigate Blackboard in order to establish the belief that the ASP solution was the right one to choose.

### **1.2.3 Strategic Factors**

#### **1.2.3.1 IT Deficiency Removal**

IT Deficiency Removal was cited as another important factor impacting the ASP adoption decision. The university did not have enough hardware, software, and IT professionals to provide the applications and services required by faculty members. Hence, they needed to find a way to fill up this lack.

“Extended enterprise edition applications need at least 8 more servers to run. The university has to buy more computer servers. It is a huge amount of money. Even [if] we would buy more servers; we still need more IT professionals to run these servers.” [Informant at OCS]

“We have some good IT professionals. But we do not have enough. Yeah, OSC needs more IT professionals. Our center also needs more.” [Informant at CELT]

“Only two people are doing Blackboard but neither of us will do it full time. It’s just one part of our job. And we have only four or five people in an application service center which supports the phone calls about Blackboard from students and faculty. [Thus,] when the number of users becomes large, the support and internal monitoring become difficult.” [Informant at OCS]

“For one thing, if we are doing it on campus, we require additional hardware. It will require personnel who are currently deployed to other responsibilities. It probably means that you have to hire more personnel. So you are...considering additional hardware costs [and] personnel costs.” [Informant at University Administration]

Besides the deficiency in hardware, software and human resources it was also found that another critical IT deficiency was the knowledge to implement and support the systems. Blackboard's expertise in its application was difficult for the university to obtain internally. This kind of domain-knowledge and application knowledge was protected very well and could hardly be acquired because Blackboard was relying on its expertise to make profit.

“We need to learn from Blackboard on hardware performance control. Blackboard has rich experience in hardware performance control, while we do not know how to regulate this product and adjust their performance to the best play.” [Informant at OCS]

“The people we hire to run the application are not nearly as knowledgeable as the people [at Blackboard] in doing it. So in my opinion, the big advantage [of outsourcing] is the people doing it know most about it. If we did it, we would not know everything about it. Blackboard is not doing a very good job in documenting everything and telling us the fast and optimal way to set up the server and...[everything]. It took a year to learn what you can get right away by outsourcing.” [Informant at OCS]

“[If we do it internally], you are dealing with a novel implementation where Blackboard has all the experiences and has encountered every problem we are going to have. So when they solve the problem for one, they solve the problem for several institutions. We would not need to redo the work every single time it came out. So [outsourcing is] just more efficient.” [Informant in University Administration]

Moreover, it was found that the university also lacked the ability to provide efficient and effective support for faculty members in house.

“We found that we have to devote the staff and resources who already have their responsibilities, to support these new systems. Although we were excited about [supporting this system] and it is needed to be done, the success of [the] Blackboard application has reached the point that the entire department were looking to put their curriculums on the Blackboard. The entire responsibility level was increased there so that we caused trouble...[in] our services and training. You might say that we became a victim of our success. And it was really stressing the resources we had.” [Informant at CELT]

Interestingly, it was also found that internal IT deficiency removal was closely associated with cost. The university was looking for a balance between internal hosting and

external outsourcing, based upon the expense required to fill in the gap between current internal IT capability and desired goals. Under this context, outsourcing was considered as an option to complement internal IT capability in a more efficient way by using Blackboard's expertise in supplying applications. Hence, after shifting the burden of support and maintenance to Blackboard, the university would be able to concentrate on their core business.

“Let Blackboard take care of these staff, then we can focus on our core business--- teaching.” [Informant in University Administration]

In this case, internal IT deficiency removal was found to be an essential factor impacting the ASP adoption decision. In other words, Blackboard's data center, its professional IT staffs with their expertise in applications and its reliable support, would help the university to meet its requirements. Moreover, Blackboard's application hosting would allow the university to focus on its main business. Thus, internal IT deficiency removal became a significant motivation for the university to adopt the ASP solution for course management.

### **1.2.3.2 Application Importance**

Online course management application was cited as a critical function in the university. Hundreds and thousands of students used Blackboard as their online course management system. A small problem would have had terrible results in some cases.

“Because we have tens and thousands of accounts every semester, the course website can not go down. It got to be very reliable.” [Informant at CELT]

“We can not even think about [the shut-down of Blackboard application]! You are exactly correct. You may not notice that, right now, [Office of Computing Service] can do [reboot and recovery] with Blackboard very quickly, because we control it on campus. Our technical staffs look at it very closely. We gave up that control. What are their server redundancy, backup, outside document storages, and others? The Blackboard entire business depends [upon] whether they would be able to do that. If it goes down, you know, for any university, that is a very serious problem.” [Informant at CELT]

“Blackboard is very important to our university.” [Informant at University Administration]

“Blackboard application is a very critical application. There are some people saying, it is as important as payroll systems and student registration system. It is becoming a core resource. If we give this application out, we have to make sure everything will be fine.” [Informant at CELT]

Particularly, it was found that in the university, many courses were fully or partially offered online.

“We have some classes totally offered online. Mine was last spring.” [Informant at University Administration]

“If you mean that the students will never come to the campus. The answer is “Yeah”. Also, we had a huge amount of “high-tech” courses. A substantial amount of course work, student communication and document transfer, were done outside a physical classroom meeting. Plus there are a few class meetings. Instead of meeting 15 weeks in class, you only meet 6 or 7 a semester.” [Informant at CELT]

Informants indicated that outsourcing important applications would result in high dependence on external vendors. The extensive usage of online course management systems required good support and maintenance of the applications. If the applications were outsourced, the university would have to depend on external vendors.

“Students need to have support from Blackboard, not just technical guys at school or myself. If you were a student [and] you were doing some significant work, if you encounter some problem with [your] account or whatever, you have to have a way to contact Blackboard, identify yourself and get the results.” [Informant at CELT]

It was also found that the concerns associated with this important function made the adoption decision more serious. The university had to find the way to control its dependence on an external vendor.

“We have to be more careful in making the decision. It will impact our daily course teaching directly. It is not just an individual thing.” [Informant in University Administration]

“As I said, it is a very important function to us, so we spend a lot [of] time making sure Blackboard is just what we want. We called other

universities, attended trade shows, and invited them to school. It is not an easy decision to make”. [Informant at CELT]

Hence, the high dependence associated with the importance of this application made the university cautious when they tried to make the final decision. Even though the university had one and a half years’ experience using this system, it still took these decision makers a long time to make up their minds.

#### **1.2.4 Moderating Relationship**

In this case, it was found that trust in Blackboard’s applications did affect the university’s consideration of economic and strategic factors.

Although cost benefits were cited as an important factor in the ASP adoption process, the university did not go with the ASP that offered the lowest price. Other factors affected their decision. The university had the choice to outsource to several available vendors offering similar functions. However, faculty members had already used the Blackboard application for almost three years and were satisfied with it. This familiarity and satisfaction with Blackboard’s application added more weight to the decision to outsource to Blackboard. Hence, trust mainly built upon Blackboard’s capabilities exerted influence on the ASP adoption decision.

“If the price is a little bit higher, we would go with it, mainly because the faculty knows how to use it and trusts this system. If we switch to a cheaper company, then the faculty will relearn every time we change. So you lose the efficiency of faculty being able to do their courses. I do not know what kind of price you can put on that. They would not be happy.” [Informant in University Administration]

Moreover, it was found that trust in Blackboard’s system gave the university more confidence to outsource this important application.

“You have to have a higher level of trust that they can do as good a job as we would do...for ourselves if we would do it. Because we have tens and thousands of accounts every semester, the course website can not go down. It has got to be very reliable.” [Informant at CELT]

“We trust Blackboard’s capability. For most of our requirements, they did satisfy us. Though we still have some technical issues, generally, we are satisfied with their services and systems.” [Informant at OCS]

Furthermore, it was found that because of the trust built upon this online course management system, the university went even further to outsource more important functions to Blackboard in order to compensate for other internal IT deficiencies.

For example, the university updated the software license from basic level (level I) to level III, and the new system was able to provide more functionality, including a student ID card function. This ID card application was initially developed in-house, integrating all point-of-sales services for students, and originally, the university only considered outsourcing online course management systems. However, it was found that after the university had known more about Blackboard and established full trust in Blackboard, the student ID card system was taken as an additional function for outsourcing because the university felt that Blackboard could manage it efficiently.

“We had some conversations with the offices using these services, because we realized our decision need[s] to be made together. We do not want the institution to wake up one day and realize that systems do a number of things. The office using these services does not know it. .... [Blackboard] is a collection from web course system to a very complex system....[Blackboard] has a large vision about campus systems... We were satisfied with its course system,... we believe [Blackboard] can provide a good ID card systems too.” [Informant at CELT]

“We also consider outsourcing student ID card systems at the same time. We are satisfied with their services on course systems. Hence, we feel they can do well in student ID card systems too.” [Informant in University Administration]

“[Blackboard] also provides the systems for [the] university’s major ID card. The ID card that you are using now interfaces with all food services all over the campus. You also can use it to buy football tickets and make copies. This is another important business to the university.” [Informant at CELT]

Hence, the university’s trust in Blackboard’s applications had an impact on its considerations of economic and strategic factors, and in order to complement its internal IT

deficiency, it chose to outsource two important applications, course management and student ID card, to Blackboard, even though less expensive vendors were available.

### **1.2.5 New Factor**

Besides the above factors proposed in the research model, in this specific case a new factor, an internal parallel system, was discovered to impact the ASP adoption decision. In this section, this factor is discussed in detail.

#### **1.2.5.1 Internal Parallel System**

As described in the section on the background of the case study, the university developed an internal web-based course menu system, called *Semester Book* in 1998. The Semester Book was based on Lotus Notes systems. It was built on the same systems with Paws, an internally developed portal. It had the interfaces integrated with student record databases and a number of administration and application programs.

However, as it was not a commercial product, some functions were not developed very well, and it was hard to use. Due to these reasons, at that time, some faculty members started to look for a good product that could provide similar functions, resulting in the pilot project of Blackboard. This project was hosted only by a small group of faculty members. When the user demands exceeded their capabilities regarding servers, support efforts and training services, the hosting responsibility had to be pushed up to the university level. Thus, the university faced the difficulty of supporting two similar systems.

It was cited that these two systems had their strengths and weakness.

“The Semester Book has some advantages that Blackboard doesn’t have. It is integrated with student record databases. Blackboard ...[did] not. It is a third-party program. [Take for example [the] student’s roster, we have to export... [it] from the student record database and input [it] into [the] Blackboard platform manually, then manipulate... [it]. That happens many times for all the courses.” [Informant at CELT]

“But Semester Book was not like today. Even now, it is still limited in what it could do and a lot of faculty members find [that] it is hard to use.” [Informant at CBA]



“Both serve the same purpose. But each one has different advantages. The faculty [that] used Blackboard found it’s friendlier. Though the features are similar, the [Blackboard’s] interface is friendlier.”  
[Informant at CELT]

“The faculty members found Blackboard has a friendlier interface”  
[Informant in University Administration]

However, though these two systems had different advantages, most functions were redundant. It was found that the university did not have enough resources to manage the two systems simultaneously very well, regarding scale of server, daily maintenance, and support.

“We have to devote the staff and resources, who already have their responsibilities, to support Blackboard systems. We were killing ourselves and doing something that was really essentially duplicated with something being already done over [at] [the] Office of Computing Service[s].”  
[Informant at CELT]

“We do not have enough servers to run Blackboard applications well. We only have two staff administering the systems. They do not work for it full time.” [Informant at OCS]

It was also found that though the university had difficulty in hosting two systems, it was impossible to get rid of either one, as both had a large number of users. Thus, the university had to support both systems.

“A number of faculty members reported that they have all [their] course materials on Blackboard. Semester Book is also extensively used.”[Informant at OCS]

“There are a substantial number of faculty members using Semester Book that was provided by [the] Office of Computing Services.”  
[Informant at CELT]

“Semester Book, just like Blackboard, grew popular every semester. Now we have over 1100 course sections using Semester Book. So we can’t stop using it. We have so many people relying on it.” [Informant at OCS]

“Semester book and Blackboard are used at the same time and both have a large number of users. We can not replace either one by another. ”  
[Informant in University Administration]

“The university has officially announced that they will host both Semester Book and Blackboard.” [Informant at OCS]

However, the university also realized it was not an optimal solution to maintain redundant systems in-house.

“So as an institution, we were going in...two different directions [at] one time, which was duplicating services, efforts and resources. It did not look good, although it was exciting. Faculties had the chance to use a good system. But we realize that we should do it and do it better.” [Informant at CELT]

Hence, in this situation, outsourcing turned out to be a possible solution to the university in order to maintain two similar systems at the same time.

“Outsourcing Blackboard application[s] can allow us to focus only on Semester Book, which we have more expertise on. Still, faculty members can choose the one they like.” [Informant at CELT]

“Blackboard can do a good job in providing their systems. We can do better on Semester Book. It is just more efficient for us.” [Informant at University Administration]

Interestingly, it was not clear to these decision makers whether one system finally would replace another. It seemed that this kind of redundancy would exist for a while.

“We don’t know..... Only time will tell what can happen.” [Informant at OCS]

“We are not going to replace either system, .... at least not recently.” [Informant in University Administration]

The relatively low costs and flexibility associated with the ASP business model enabled the university to afford two systems at the same time. In this case, due to the university’s history, internal parallel systems actually became the driver to boost the outsourcing of Blackboard’s online course management systems.

## VITA

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