Software-as-a-Service Model: Elaborating Client-Side Adoption Factors

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SOFTWARE-AS-A-SERVICE MODEL: ELABORATING CLIENT-SIDE ADOPTION FACTORS*

Abstract

Software-as-a-Service (SaaS) is emerging as a viable outsourcing option for clients interested in paying for the right to access a standardized set of business software functions through the network. SaaS model largely replaced the Application Service Providers (ASPs) model, by creating an architecture that provides no mechanisms for customizing the software on the vendor side; all customization is done on the client side through standardized interfaces. The fact that vendors are not making any client-specific investments makes this outsourcing model quite intriguing. In this paper we investigate client's side determinants the SaaS model adoption. We draw on economic, strategic management, and Information Systems theories to develop a theoretical framework. By integrating diverse literature streams, we are able to develop a more elaborate view of uncertainty arguing that some types uncertainty increase the propensity to adopt SaaS, while other types do not. Finally, we argue that the maturity of the client's internal enterprise IT architecture plays an important role in SaaS adoption decisions.

Keywords: Software as a Service, SaaS, Outsourcing, ASP, IT architecture maturity, Property Rights Theory, Resource Based View, IS Strategy.

Introduction

The enterprise software market is seeing the rise of a new business model—selling Software-as-a-Service (SaaS). In this model, a standard piece of software is owned and managed remotely by the vendor and delivered as a service over the Internet. The application is based on a single set of common code and data definitions and distributed in a one-to-many manner to all clients. SaaS market has seen a double-digit growth for the past three years and surpassed $5.1 billion in revenue in 2007 (Mertz et al. 2007). A McKinsey survey ranks SaaS as one of CIOs' top two critical focuses in 2007 (Dubey and Wagle 2007). By 2010, 30% of the new business software is expected to be delivered via the SaaS model (Pring 2005).

The SaaS model evolved from the application service provider (ASP) model, which emerged in the late 1990s, but did not take off as predicted by analysts. ASP model involved a vendor managing and delivering application capabilities from a data center accessed across the network (Randeree et al. 2008). It had three critical features: 1) clients rented from an ASP access to commercial off-the-shelf software packages; 2) client faced no up-front capital costs as the price was based upon usage; 3) a client-specific instance of an application was located offsite and delivered over the network. However, clients could still customize their instance of the application on the vendor's server to some extent. A key issue surrounding ASP adoption became the degree of customization desired by the client and the resulting efficiency loss by the vendor. The doomed ASP model was soon reinvented into the SaaS model, which relied on a different architecture. In this new multitenant architecture, only a single instance of the common code and set of data definitions for a given application exists on the vendor's server, and no customization of this code is permitted. Customer-specific configuration can be made at the meta-data layer on top of the common code using interfaces provided by the SaaS vendor. The service can be integrated with other applications or connect

with more custom functions through common web services application programming interfaces (APIs) that are defined and maintained by SaaS vendors (Chong and Carraro 2006)[1].

The new architecture has three important implications: First, it constrains clients' options for customization of the main functionality and data structures of the software. Second, the SaaS model gives more control over future development to the vendor as clients have no choice but to adopt future upgrades of software if they continue using the service. Indeed, when one of the flagship SaaS products, Salesforce.com, came out with a new release in June 2008, the CEO of the company admitted that some of its customers might have to re-implement their customizations because the interfaces would not be backward compatible in some areas. Third, the architecture of SaaS allows for the separation of maintenance responsibilities between the SaaS vendor and the client. In particular, the SaaS vendor is responsible for maintaining the common code base that delivers the standard application services to all customers; while each customer is responsible for maintaining their custom-developed code. Thus, this model *no longer requires any client-specific investment by the vendor.*

While SaaS adoption has been more widespread than ASP adoption, its appeal is not uniform by any means. SaaS solutions are offered in virtually every software product segment, yet adoption varies widely contributing as little as 3-4% in revenue in the enterprise resource planning (ERP) market and more than 75% in the web conferencing market (Mertz et al. 2007). Moreover, while SaaS model was initially targeting small and medium-sized enterprises (SMEs), today even large firms like CitiGroup and Cisco have adopted SaaS for some application (e.g., sales force automation). Thus, SaaS model offers advantages for some types of application and to some clients but not others. The goal of this research is to understand what factors drive clients' adoption of SaaS.

Adoption of ASP or SaaS can be seen as a type of an outsourcing decision. In the past, outsourcing literature was used to help formulate predications regarding ASP adoption. In general, studies of ASP adoption find that clients' preferences for ASP adoption resemble their preferences for outsourcing other services (Jayatilaka et al. 2003; Kern et al. 2002; Randeree et al. 2008; Yao 2004). In this paper, we also draw on outsourcing literature; however, we argue that some unique features of the SaaS model change standard outsourcing theory's predictions. Moreover, to the best of our knowledge, this is the first study of SaaS adoption specifically, as prior studies have not distinguished SaaS from ASP (Randeree et al. 2008). Even in a prior study of SaaS pricing, the features of SaaS that were modeled were no different from the features of ASP, namely, subscription-based pricing and offsite data location (Ma and Seidmann 2005). In addition, we contribute to outsourcing theory by incorporate client's own enterprise architecture maturity as a factor predicting SaaS adoption. Incorporating clients' architectural maturity as a predictor of an outsourcing decision is a new and exciting direction in IS outsourcing research (Ross and Beath 2006; Tanriverdi et al. 2007).

The rest of the paper focuses on theory development that integrates economic, strategy, and Information Systems (IS) theories in predicting SaaS adoption. We conclude with a brief note on our empirical approach, limitations, and expected contributions.

Background Literature

Looking at SaaS adoption as an outsourcing decision, we draw on a number of theories typically applied to analyzing IT outsourcing decisions (Dibbern et al. 2004; Hui et al., 2006). Many of these theories (Production Cost Economics, Resource Based View (RBV) of the Firm, Incomplete Contract theories) are theories of firm boundaries and involve consideration of relative costs, competencies, and incentives of clients versus vendors involved in the transaction. Incomplete Contract theories have been applied extensively to IS sourcing decisions. These theories focus on the difficulty of writing complete contracts in situations when parties need to make specific investment in assets and the uncertainty is high. By and large, IS literature has drawn on Transaction Cost Economics (TCE) as a primary incomplete contract theory (Dibbern et al. 2004; Hui et al. 2006); however, Property Rights Theory (PRT), which is another incomplete contract theory, has not been widely utilized in the studies of IS outsourcing. PRT is more applicable to our study than TCE because PRT focuses more on asset ownership issues than TCE, and asset

[1] This definition, adapted from Microsoft Research, is consistent with the ones used by leading IT market research firms such as Gartner and Forrester (Mertz et al 2007), and hence is widely accepted. Nonetheless, careful scrutiny is needed while using the results of this paper in other contexts as different definitions are sometimes used by individual software/service vendors.

ownership is at the heart of SaaS adoption. In addition to the "more rational" theories of firm boundaries, institutional theory has been used to consider an outsourcing decision as an outcome of institutional forces often exhibited as managerial feds and fashions. Finally, clients' IT architecture has emerged as part of IT outsourcing research arguing that different levels of IT architecture maturity may fit different sourcing models. Table 1 summarizes these theories and the variables that are key to them. We will draw on these theories in developing our research model and hypotheses.

Table 1: Theories Informing Outsourcing Decision

Theories	Summary and applications to IT outsourcing	Key Variables
Production Cost Economics	Production cost advantages can be developed through the scale and/or scope of production (Alchian and Allen 1969; Panzar and Willig 1981). External vendors generate their scale and scope by pooling demand from a large number of customers and often managing multiple functions simultaneously. This, in turn, justifies their large investment in specialized technologies and human resources. IT outsourcing is often seen as a result of client's desire to access vendors' economies of scale and scope (McFarlan and Nolan 1995; Ang and Straub 1998; Levina and Ross 2003). At the same time, many large organizations are able to utilize their economies of scale and scope internally (McFarlan and Nolan 1995). Thus, IT outsourcing becomes the question of relative advantage. At the time when business and technical environments are uncertain, IT outsourcing becomes a way of dealing with demand volume uncertainty as the vendor can use economies of scale and scope to aggregate the demand (Carlton 1979). Another source of cost saving could come from financial costs. Firms with high cost of capital can economize on their fixed capital costs by creating a cash infusion through sale and lease-back of their IT assets through outsourcing contracts (Loh and Venkatrama 1992a; Smith et al. 1998).	Vendor's versus client's economies of scale and scope in IT Uncertainty of demand Client's cost of capital
Resource-Based View of the Firm	RBV suggests that capabilities of firms *vis a vis* their transaction partners are important determinants of sourcing decisions (Barney 1999; Van de Ven 2005), and an activity should be outsourced if it is not a core competence of a firm (Quinn 1999; Prahalad et al 1990). Investments in IT can become strategic by helping firms develop their core competencies (Sambamurthy et al., 2003). Thus, firms may want to own and control those IT resources that are closely related to their unique capabilities and thus require heavy customization and continuous innovation (McFarlan and Nolan 1995, Nam et. al, 1996). RBV also implies that if internal IT function of an organization is strong – large, well managed, and strategically aligned with the rest of the organization – then the firm benefits less from accessing vendors' generalized IT competencies (McFarlan and Nolan 1995; Levina and Ross 2003).	Client's need for unique customized functionality Client's IT capability
Property Rights Theory	PRT studies the role of firm boundaries in providing incentives for making relationship-specific investments (Grossman and Hart 1986; Hart and Moore 1990). A firm is composed of assets that it owns. Asset ownership conveys formal control over the uses of an asset, when such control has not been pre-specified in the contract. Thus, when the contract fails to direct the transaction, the asset owner is able to negotiate a more favorable division of surplus against agents who do not own the asset (known as the hold-up problem). Uncertainty increases the cost of writing a complete contract and also the likelihood that the contract will remain incomplete and fail to direct transactions. In case of outsourcing, a client would want to own those assets for which there is	Asset Specificity Uncertainty

	a need to make asset-specific investments to gain greater productivity, but for which the vendor can gain little value from making such investments outside the relationship with this specific client.	
Institutional Theory	Institutional theory seeks to explain the homogeneity of organizational forms and practices that are not necessarily motivated by efficiency purposes. External influences such as government regulation, peer organization's successful experiences, media and third-party communications could also drive firms' sourcing decision (Ang and Cummings 1997; Loh and Venkatraman 1992b; Hu et al. 1997). This view is especially relevant in the current context given the growing popularity of the SaaS model in the marketplace.	Institutional Influences (regulation, peer pressure, media, etc.)
IT Governance Theory	Enterprise IT architecture refers to "the organizing logic for applications, data and infrastructure technologies, as captured in a set of policies and technical choices, intended to enable the firm's business strategy" (Ross 2003). Building a strategic enterprise IT architecture is a challenging process. Ross and her colleagues (2003, 2006) find that firms attempting to design, implement, and leverage enterprise IT architecture go through 4 distinct stages: business silo, standardized technology, rationalized process and business modularity architecture. Moving up a stage increases the strategic value of IT and enhances enterprise effectiveness. Firms with different levels of enterprise IT architecture maturity benefit differently from different types of sourcing arrangements (Ross and Beath 2006).	Enterprise IT architecture maturity

Research Hypotheses

In developing the theory we only focus on the implementation of commercially available software, excluding customized application development. Also, for our initial investigation, we consider only two implementation choices: SaaS adoption or on-premises implementation. SaaS model is defined above. We define the on-premises model as a software service model in which customers purchase the permanent licenses of the commercially available software, and their internal employees maintain the application and the infrastructure associated with it. We first summarize our research model in Figure 2 and then explain how we generated the hypotheses indicated in it.

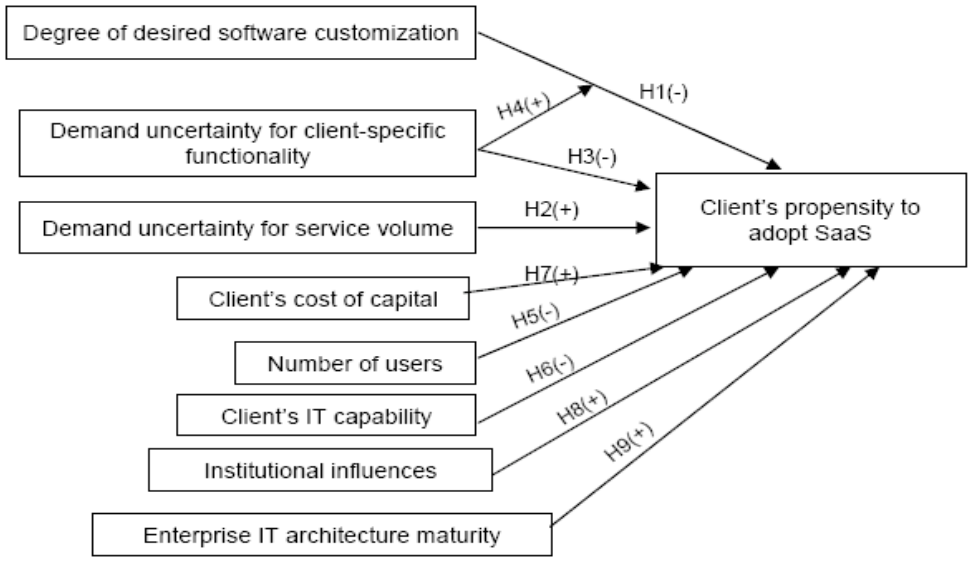

Figure 2. Research Model

Degree of Desired Software Customization

The functionality that is provided by a commercial software application often does not fit individual clients' requirements in terms of their idiosyncratic business processes or integration with other software applications. In such cases, clients can either change their organizational practices to fit the software or customize the software application to fit their needs at some cost (Lucas et al. 1988; Soh et al. 2000; Francalanci 2001). While for some applications customers will be willing to adjust their needs, for more strategic applications the idiosyncrasy of business processes and other related applications may constitute competitive advantage. Thus, according to RBV, customization of such application is valuable and should not be compromised. The architectural model employed by SaaS restricts clients' access to the core of the application. Thus, if the client wants to customize the core of the application they need to own it. Even if the client is able to use the standard core, they may want to build components on top of the core functionality (using APIs) to suit their needs for integration and customization (Susarla et al. 2001). With the SaaS model, the vendor does not customize the code or data definitions for individual clients and thus make no client-specific investments; clients are responsible for making and maintaining all the customized components that are software-specific. However, according to PRT, the client may have little incentive to invest in such customization efforts in this case, even if such efforts were to result in greater overall productivity for the client because of the potential hold-up problem this may entail. Vendor's ownership of the core of the application and common interfaces gives the vendor more bargaining power in the future if the client had invested a lot in customization. For example, the vendor may raise prices or refuse to invest in maintaining backward compatible interfaces. Finally, in terms of the production-cost economics, clients who desire more customization will get less cost savings from the SaaS model as the vendor will maintain a smaller portion of the overall application as compared to those customers who use the standard software without much customization. Thus,

H1: Clients with a higher degree of desired customization for a given software application are less likely to adopt the SaaS model than the on-premises model.

Uncertainty

The relationship between uncertainty and IT sourcing decisions has been somewhat of a theoretical and empirical puzzle. Findings from different studies appear to contradict each other. Studies grounded in incomplete contract theories emphasize that higher level of environmental uncertainty increases the cost of writing a complete contract and leads to transaction costs (Aubert et al. 2004; Loh 1994; Poppo and Zenger 1998). In case when relationship-specific investments have to be made, these theories suggest not outsourcing.

In comparison, works grounded in production cost economics argue that firms facing higher environmental uncertainty should disintegrate to increase flexibility to adept to change by tapping into vendors' more flexible capacity and ability to recoup fixed investments over multiple clients (Carlton 1979; Slaughter and Ang 1996; Levina and Ross 2003). RBV also argues for outsourcing in case of environmental and technological uncertainty as specialized vendors may be more effective by relying on their agile capabilities in responding to change (Poppo and Zenger 1998; Quinn and Hilmer 1994).

Empirical research has not been able to provide consistent evidence regarding the effect of environmental uncertainty on firms' sourcing choices, with some studies finding positive association between uncertainty and outsourcing (Ang and Cummings 1997; McLellan et al. 1995; Poppo and Zenger 1998), some finding negative association (Aubert et al. 2004), and others no significant association at all (Loh 1994). Macher and Richman (2007) and Rindfleisch and Heide (1997) propose that uncertainty of different types drives firm boundary decisions in different directions. We focus on two types of uncertainty in this study, clients' demand uncertainty for service volume and for customized functionality, and hypothesize how they drive client's preferences for sourcing.

Demand uncertainty for service volume

When there is uncertainty in client firms' demand for service volume (e.g., volume of transactions, number of licenses, etc.), according to the production cost economics, external service vendors are more efficient in bearing the risk since they can pool demand from many clients and are able to meet the same demand with less redundant capacity (Carlton 1979). In particular, when clients' demand shocks are not highly correlated, according to the law of large numbers, vendors can be more efficient in handling demand volume uncertainty. The SaaS model allows clients to change the capacity of their application on the fly without investing in new infrastructure, training new personnel, or implementing new software licenses. At the same time, the uncertainty in service volume is unlikely to

increase contract incompleteness since service volume for a standard application can be explicitly measured by variables such as storage space, transaction volume, and number of licenses – variables that are well established in the industry. It is fairly easy to develop contingent pricing metrics based on these variables. Most SaaS vendors are explicit about their pricing of different service volume requests. Thus,

H2: Clients with higher demand volume uncertainty for a given software application are more likely to adopt the SaaS model than the on-premises model.

Demand uncertainty for client-specific functionality

Clients' demand for functionality for a particular application may evolve as clients experience the software and as their business changes (Kemerer and Slaughter 1999; Perry 1994). The newly developed functionality needs may require customization if they are not met by the vendor. The SaaS model constrains clients' customization options. In this case, clients that adopted the SaaS model may want to switch to alternative hosting models or software vendors that provide such capacity, especially if their need for customization is perceived to offer strategic benefits. When there are costs involved with switching to alternative options, PRT suggests that clients with high demand uncertainty for specific functionality should own the software to gain more control in customizing the software down the road. Thus:

H3: Clients with higher demand uncertainty for client-specific functionality for a given software application are less likely to adopt the SaaS model than the on-premises model.

Moreover, those clients that have invested in software-specific customization may be more locked in with their current vendor as these investments would have less value without access to the software. Thus, according to PRT clients that desire high degree of software customization may prefer the on-premises model even more, when there is uncertainty in specific functionality. Thus, there is a moderation effect:

H4: Demand uncertainty for client-specific functionality moderates the relationship between the degree of desired customization and client's propensity to adopt SaaS model for a given application.

Our discussion of SaaS focuses only on the choice of the hosting model and assumes that features of the standard software package are the same in on-premises vs. SaaS adoption. Thus, the kind of technological uncertainty that is often associated with outsourcing decisions and that has to do vendors efficiencies in incorporating new technology and creating new features as technological environment evolves is not directly applicable here. This issue has more to do with the decision of whether to adopt packaged software or to do a customized application development. Thus, the traditional RBV based argument (Quinn and Hilmer 1994) that vendors can use their specialized capabilities to invest in new technologies more efficiently is not applicable to this decision.

Number of Users

Based on production cost economics, clients with sufficient number of internal users may be able to achieve economies of scale in operating a software application internally through employment of specialized technical infrastructure (e.g., hardware) and IT professionals and spreading these fixed costs over a large number of users (Lacity and Hirschheim 1993; Levina and Ross 2003). Indeed, prior studies have shown that the cost benefit of mass production tapers off after a certain scale, and some large firms are able to be more cost efficient in terms of cost-per-MIP than large vendor-run data centers (Willcocks et al. 1995). Furthermore, given that SaaS model's pricing is typically on a per-user basis, the cost of external service contract is likely to increase faster with the number of users than the cost of the on-premises model. Thus,

H5: Clients with a large number users for a given software application are less likely to adopt the SaaS model than the on-premises model.

Client's IT Capabilities

According to RBV and production cost economics, firms with large and well-managed internal IT departments are likely to manage a large number of diverse IT projects gaining both technical competence and business know-how most applicable to their firm (McFarlan & Nolan, 1995). They are likely to have both hardware capabilities and software implementation and maintenance experience to be able to implement a given application in-house in an efficient and effective manner. Thus:

H6: Clients with more extensive internal IT capabilities are less likely to adopt the SaaS model for a given application than the on-premises model.

Client's Cost of Capital

With the SaaS model, software applications are deployed on vendors' premises prior to a client's adoption. Clients do not purchase software or infrastructure (e.g. hardware and OS) upfront, but pay for their access to the services over time. Implementation cycle is shortened, since applications are already deployed on SaaS vendors' sites. The SaaS model also allows extensive cost savings in operating standard business components on a large scale. Accordingly, firms with high cost of capital may find the SaaS model more beneficial as it enables them to economize on fixed capital cost by spreading the service cost over time, allows faster time to value, and potentially brings significant cost savings (Sharpe and Nguyen 1995). Thus, following production cost economics:

H7: Clients with high cost of capital are more likely to adopt the SaaS model than the on-premises model.

Institutional Influences

The SaaS model is becoming increasingly popular. The SaaS market is in the midst of a five-year period of 43 per cent average annual compound growth (RBC 2007). The two SaaS pioneers, Salesforce.com and Oracle, both signed up their millionth user by the end of 2007. Firms using SaaS reported substantial efficiency benefits from the adoption (Dubey and Wagle 2007). Numerous SaaS conferences are held all year round by premier IT market research companies, and in some cases, SaaS user groups are formed that provide a platform for IT professionals from client firms to exchange their experiences with SaaS and promote the adoption of this model through events, education, promotion, and so on. Despite of such extensive exposure, concerns about data security, customization, integration, etc. are still major barriers to the adoption of SaaS. The new software architecture employed by SaaS also faces several technical challenges, and the underlying technology is going through rapid changes. Given multiple pros and cons, organizations may forgo rational calculations in favor of mimicking their successful peers (Loh and Venkatrama 1992b; DiMaggio and Power 1983). Thus,

H8: Clients that are more receptive to peer organizations' influence in their IT decision making are more likely to adopt the SaaS model.

Enterprise IT Architecture Maturity

A firm with more mature enterprise architecture makes increasing use of standardized infrastructure, data management, and business processes. This makes it easier to isolate individual processes from other activities and employ external service vendors' best practices for these processes. A consolidated and standard infrastructure also provides a good foundation for a firm to leverage reusable modular business services that are typically offered by SaaS vendors (Ross 2003). Finally, firms with more mature enterprise architecture are more likely to have developed standard interfaces so that they can readily integrate with SaaS vendors' industry-standard components at a competitive cost level (Ross and Beath 2006). Thus, we hypothesize

H9: Clients with more mature enterprise IT architecture are more likely to adopt the SaaS model.

Progress to Date and Expected Contributions

We plan to test the proposed hypotheses by collecting data on firms' choice of software service models and their demand characteristics. We have used prior literature and in-depth qualitative interviews with CIOs making adoption decisions to develop measures for each of the above constructs. Since our research model involves both a binary dependent variable and several latent independent variables, we plan to use a two-step procedure proposed by Anderson and Gerbing (1988) to estimate our research model. We first employ confirmatory factor analysis (CFA) to examine the construct validity. The loadings from the CFA model are used as item weighting factors to construct aggregate scores for each latent variable (Pedazhur and Schmelkin 1991). Next these scores are used in a discrete choice model to describe clients' preferences for different software service models and test the proposed hypotheses (Parmigiani 2007; Coviello et al. 2002). We have pilot-tested our model using data collected through an online

survey of a small sample of senior IT managers in client firms. The results show that the instruments are quite robust. Data collection from a large sample is currently in progress.

This is a first in-depth study of SaaS adoption and as such it has a number of limitations. We focus on a binary choice (SaaS versus on-premises) and ignore a wider range of options that an organization has, such as a fully customized implementation hosted on a 3rd-party vendor's servers. Also, we limited our consideration to a static model as opposed to studying how firms' sourcing decisions evolve over time. Finally, prior ASP literature suggests vendor and its market maturity is also influential to the adoption of a new service model (Kern et al. 2002). Our future research will focus on addressing these other dimensions of the SaaS adoption phenomenon.

Overall, this research makes three major contributions. First, this is the first paper that investigates clients' adoption of the emerging SaaS model, while making a clear distinction between the SaaS and ASP models. Although both models promised to deliver many of the same benefits to customers, differences in the underlying technical and managerial considerations altered the adoption patterns. Our model helps explain the reasons why SaaS is more successful in the marketplace. In essence, as compared to ASP, SaaS both increases the production side efficiencies and decreases incentive misalignment making outsourcing more attractive. Specifically, the vendor who is more proficient with standard functionality and hosting is now responsible only for that component, and the client who is more proficient in customization is now responsible for making and maintaining the customized component. Because of this clear division of labor, the transparency of the transaction is much improved and the usual hold-up problem in IS outsourcing associated with client's need for vendor to customize applications is avoided. Indeed, SaaS vendors are typically quite explicit in their pricing strategies announcing per sit pricing for various product features with no hidden costs. While there is still a possibility for hold-up associated with vendors' ownership of the software, the uncertainty associated with this transaction can be anticipated: the vendor may raise prices for new versions of software in a long term or the vendor may change interfaces creating new integration costs. Thus, if the client cannot tolerate this anticipated uncertainty, they would rather own their application than adopt SaaS. Overall, given much reduced transaction costs and much improved production efficiencies the SaaS model became more successful than the ASP model.

Second, we extend prior outsourcing literature by developing a more elaborate view of uncertainty and showing how different types of uncertainty impacts the SaaS adoption decision differently. We argue that uncertainty in service volume is likely to lead to more outsourcing via SaaS model; whereas, uncertainty in client-specific functionality needs is likely to lead to insourcing. Interestingly, with the ASP model both types of uncertainty were likely to lead to insourcing as the vendor could use either of them to its advantage in a hold-up situation given a more vague contracting environment for ASP. Finally, we build on the recent developments in the IT governance literature, and argue that the maturity of IT architecture will impact SaaS adoption decision. While most prior research on IS outsourcing draws on theories developed in management and economics literatures, establishing a relationship between IS architecture maturity and outsourcing decisions helps us draw on and contribute to unique theories constituting IS discipline. Thus, we develop an integrative and generative theoretical framework upon which more work can be built explaining IS sourcing decisions in general and SaaS adoption in particular.

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