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

Le modèle des logiciels en mode hébergé : identifier les facteurs d'adoption selon le point de vue du client

Research-in-Progress

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Abstract

Software-as-a-Service (SaaS) is emerging as a viable outsourcing option for clients interested in paying for the right to access through the network a standardized set of business software functions. SaaS model largely replaced the Application Service Providers (ASPs)-based model, by creating an architecture that 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 of adopting the SaaS model. We draw on economic, strategic management, and IS theories to develop a theoretical framework. In it, we develop a more elaborate view of uncertainty as some types uncertainty increase the propensity to adopt SaaS, while other types do the opposite. Finally, we integrate the role of the internal enterprise IT architecture into our model.

Résumé

Les logiciels en mode hébergé (SaaS) émergent comme une option d'externalisation viable pour les clients qui souhaitent payer un droit accès via le web à des fonctions standardisées de logiciels d'entreprise. Des théories issues de l'économie, du management stratégique et des systèmes d'information aident à conceptualiser un modèle théorique expliquant les décisions d'adoption du SaaS par les clients.

Keywords: Software as a Service, application outsourcing, ASP, IT architecture maturity

Introduction

The enterprise software market is seeing the rise of a new business model—selling Software-as-a-Service (SaaS), in which 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. This emerging market has seen a double-digit growth for the past three years, and is projected to surpass $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 vendor 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 efficiencies lost by the vendor. The 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 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 had three important implications: first, it constrains clients' options for customization of the main functionality and data structures of the software. In traditional adoption of packaged software, clients can choose how to implement the package and later decide on where to host their instance of the package. In the SaaS case, clients are simultaneously making their implementation choice (agreeing to a non-customizable common code layer) and their hosting choice (with the SaaS vendor as opposed to on-premises or through a third party hosting service). Second, SaaS model gives more control over future development to the vendor as the client has 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 applications 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.

SaaS adoption has been more rapid than ASP, but there are many variations in its adoption still. SaaS solutions are offered in virtually every software product sector, but contribute as little as 1-2% in revenue in the enterprise content management (ECM) market and more than 75% in web conferencing market (Mertz et al. 2007). Moreover, while ASP and SaaS models were initially targeting 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.

Outsourcing literature provided the basis for understanding factors leading to ASP model adoption, because it can be seen as a type of an IT outsourcing model. The literature on ASP adoption finds that clients' preferences for ASP adoption resemble their preferences for outsourcing in general (Jayatilaka et al. 2003; Kern et al. 2002; Randeree et

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[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 sometimes are used by individual software/service vendors.

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. 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 client's 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 IS theory 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 ownership is at the heart of SaaS adoption. In addition to "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, client's 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.	Vendor's versus client's economies of scale and scope in IT
	IT outsourcing is often seen as a result of client's desire to access vendors' economies of scale and scope (McFarlan & Nolan 1995; Ang and Straub 1998; Levina & Ross 2003). At the same time, many large organizations are able to utilize their economies of scale and scope internally (McFarlan & 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 this uncertainty in both labor and asset ownership as the vendor can deal with demand uncertainty in more efficient fashion (Slaughter & Ang, 1996; Levina and Ross, 2003).	Uncertainty of demand
	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).	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).	
	Outsourcing non-core activities may also help firms deal with environmental uncertainty as specialized vendors should have better agile capabilities for handling change (Poppo and Zenger 1998; Quinn and Hilmer 1994).	Uncertainty
	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 best in class capabilities, making these IT resources strategic (McFarlan and Nolan 1995, Nam et. al, 1996).	Strategic importance of the IT application
	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 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.	Asset Specificity
	In case of outsourcing, a client would want to own those assets for which there is 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.	Uncertainty
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 market place.	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.	Enterprise IT architecture maturity
	Firms with different levels of enterprise IT architecture maturity benefit differently from different types of sourcing arrangements (Ross and Beath 2006).	

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.
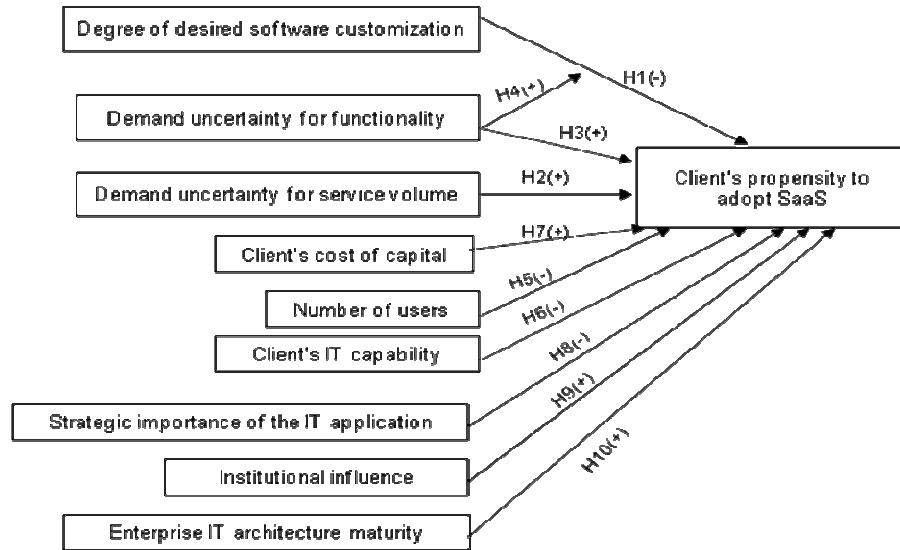

Figure 2. Research Model

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).

The architectural approach of SaaS shifts specific investment to the client: the vendor does not customize the code or data definitions on its servers, and the client is responsible for maintaining all the customized components. 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). However, according to PRT, the client may have little incentive to invest in such customization efforts, 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 code as compared to those customers who use the standard application 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 firm-specific investments have to be made, these theories suggest not outsourcing.

In comparison, work grounded in RBV and 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 (Balakrishnan and Wernerfelt 1986; Slaughter and Ang 1996; Levina and Ross 2003). Vendors have comparative advantage in achieving flexibility in response to environmental uncertainty by aggregating demands of multiple clients and by using their specialized agile capabilities (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 application 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; Lacity and Hirschheim 1993; Perry 1989). 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 sometimes implementing new software licenses. At the same time, the uncertainty in service volume is unlikely to increase contract incompleteness since service volume 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 use the SaaS model than the on-premises model.

Demand uncertainty for 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). When clients' functionality requirements are generic, according to the production cost economics, external service providers can be more efficient in handling these changes as they can pool demand from a number of clients and develop a set of complementary core competencies, such as personnel and methodology development, to handle the environmental turbulence (Levina and Ross 2003; Slaughter and Ang 1996). The cost of such development is justified because of the vendor ability to resell functionality to many clients (Alchian and Allen 1969). Thus:

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

According to PRT, however, the efficiency gained from using an external service provider may disappear if clients' newly demanded functionality needs customization. Such customization may not be feasible due to the SaaS model's inherent limitations. Clients may consider switching to other applications that provide the required function or allow for such customization. Yet, those clients that have invested in software-specific customization may be locked in with their current vendor. Thus, when there is uncertainty in required functionality, clients that desire high degree of software customization may prefer the on-premises model even more. Thus, there is a moderation effect:

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

Number of Users

Based on production cost economics argument, 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 (Lacity and Hirschheim 1993; Levina and Ross 2003). The upfront investment costs are then spread over a large number of users. 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 use the SaaS model than the on-premises model.

Strategic Importance of the IT application

According to RBV, firms can develop unique, non-imitable, and valuable resources (core competencies) that give these firms a sustainable competitive advantage (Quinn and Hilmer 1994). Software applications that automate these strategic business processes (which we will call strategic IT applications) are likely to require extensive customization. Maintenance of these applications needs unique knowledge specific to a particular client (Prahalad and Hamel 1990). In these cases, customers are less likely to adopt SaaS, which restricts their ability to customize and offers few cost benefit with their limited adoption of standardized business processes. Furthermore, core competencies are built through a continuous process of improvement and enhancement over time (Barney 1991). This process is likely to cause changes in requirements for the underlying software services, but these changes is unlikely to be applicable to other customers(Perry 1994). Thus,

H8: Clients are less likely to adopt the SaaS model than the on-premises model for IT applications that have strategic importance to them.

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 SaaS remain. 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,

H9: Clients that are more receptive to peer organizations' successful examples of SaaS use 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

H10: 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 developed measures and survey items for each of the above constructs. Results from pretest show high internal reliability among items measuring the same construct and external validity among constructs. With the help of an IT market research firm, we have rolled out our survey. Since our dependent variable is a binary choice variable, we plan to use an extended discrete choice model, which accommodates the use of latent variables, to describe clients' preferences for different software service models and test the proposed hypotheses (Ashok et al. 2002).

Due to space limitation, our theoretical model focuses on a binary choice (SaaS versus on-premises) and ignores a wider range of options that an organization has. 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 significantly alter theoretical predictions regarding adoption patterns. For example, a customer who can accept the standardized core functionality but must have some customization of non-core functionality is likely to adopt SaaS more easily than ASP, where any customization was up to the vendor and created an incentive misalignment. Second, we elaborate how the unique features of the SaaS model change standard outsourcing theory's predictions. Drawing on PRT, which is often overlooked in the IS outsourcing literature, we argue that architectural solution used in SaaS alleviates the requirements for client-specific investments by vendors. It implies that a client should estimate the marginal benefit it will get from customizing the application at the time of making the adoption decision and should choose to own the application if the benefit is high. We also extent prior outsourcing literature by developing a more elaborate view of uncertainty and show how different type of uncertainty impacts the SaaS adoption decision differently. 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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