Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model

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A B S T R A C T
As an innovation that revolutionizes application delivery based on cloud-computing, software-as-a-service (SaaS) has seen a tremendous growth during the last few years. However, its diffusion is not evenly distributed: some organizational users are open to SaaS but others are still hesitant despite the huge cost saving it may bring. The behavioral impacts of SaaS are far-reaching and the new socio-technical phenomenon deserves a close look. Based on the literature review, this study proposes a tripod model of SaaS Readiness that suggests that organizational users need to get prepared from technological, organizational and environmental aspects for the adoption of SaaS. The empirical results support that all three aspects are important for SaaS adoption yet their influences vary across psychological and overt outcome variables.

1. Introduction

Software-as-a-service (SaaS) emerges as an innovative approach to deliver software applications based on cloud-computing technology (Chou & Chou, 2007). In this model, SaaS providers deploy software applications on cloud servers for users to order based on their needs and pay for the services according to actual usage (Armbrust et al., 2010). This “on-demand” service delivery approach is similar to utility service mode: a user just subscribes an application without the need to buy, install and maintain the software, like getting power from the grid rather than one’s own generator. In addition, SaaS enhances the quality of software services through automatic application upgrade and data backup (Xin & Levina, 2008).

SaaS allows organizations to outsource many of their applications, including generic tools (e.g. anti-virus software, e-mail, office package) and business applications (e.g. accounting, customer relationship management – CRM, enterprise resource planning – ERP). Based on cloud computing, organizations can also outsource their IT infrastructures (e.g. storage, backup and computing) in form of Infrastructure as a Service (IaaS) as well as IT platforms (e.g. database and business intelligence) in form of Platform as a Service (PaaS) (Vaquero, Rodero-merino, Caceres, & Lindner, 2009). Among the three, SaaS is considered the most promising as it gives business clients various tangible benefits, such as reduced IT costs and improved IT performance (Catteddu, 2010; Wu, 2011).

Through cloud computing, SaaS providers allocate IT resources and capacities among subscribers based on their real-time demands. Such an approach of dynamic instance and data partition management is conducive to the economies of scale. As organizations do not need to worry about acquiring and maintaining their own software applications, they can save tremendous cost and focus on productivity.

Despite the fact that more and more organizations adopt SaaS, however, its diffusion is still far from full potential due to issues like security concerns, fear of losing control, and organizational resistance (Benlian & Hess, 2011; Lee, Hoon, & Min, 2013). The outsourcing of IT functions often brings significant organizational changes, leading to the overhaul of business processes and management structures (Clark, Zmud, & McCray, 1995). Most employees are hesitant to go through such changes unless they are well prepared and motivated (Walden & Hoffman, 2007).

Thus the general incentive in terms of cost saving is not sufficient to explain SaaS adoption decisions. Rather, the behavioral impacts of SaaS that revolutionize how people acquire and use software need to be taken into account. Organizations are not likely to implement SaaS unless relevant personnel get ready. These people include users at different levels such as employees.
who use computers in their daily jobs, IT specialists who provide technical support, and managers who make decisions based on the information obtained, and they are generally referred to as organizational users (Klein, Conn, & Sorra, 2001). This study will examine the key factors that make differences in their psychological tendency to adopt the SaaS innovation.

2. Literature review

2.1. Factors relevant to SaaS adoption

Among the existing studies on SaaS adoption, Xin and Levine (2008) qualitatively assessed the influence of IT infrastructure maturity and outcome uncertainties. Similarly, Wu, Lan, and Lee (2011) found that organizations evaluate the long-term impacts of SaaS adoption, especially foreseeable and unforeseeable risks. Benlian, Hess, and Buxmann (2009) quantitatively examined the importance of perceived values, uncertainties and impacts to the attitude toward SaaS adoption. Also using the attitude toward the innovation as the dependent variable, Wu (2011) identified the significant effects of relative advantage, ease-of-use, security and trust. Benlian and Hess (2011), on the other hand, collected observations on perceived cost advantage and security concerns and recognized their impacts the decision-making related to SaaS adoption.

SaaS is built upon the cloud-computing technology, and their diffusions are closely related. There have been more empirical studies on cloud-computing adoption and their findings provide useful hints on more systematic investigation of SaaS adoption (Cegielski, Jones-Farmer, Wu, & Hazen, 2012; Lin & Chen, 2012; Low, Chen, & Wu, 2011; Park & Ryoo, 2013; Stantchev, Colomo-Palacios, Soto-Acosta, & Misra, 2014). As the literature review indicates, there are many factors that may influence the diffusion of cloud computing. Some factors are related to the innovation itself, such as relative advantage, ease of use, compatibility. Yet others are related to organization, including IT infrastructure and top management support, and external factors, such as competitor and partner pressures.

Thus an important research question is: “how different types of factors affect user adoption of SaaS”. Existing studies focus on different sets of factors based on the theoretical frameworks that they employ. For instance, the studies on technology-related factors may include relative advantage and compatibility based on Rogers’ (1995) innovation diffusion theory (IDT), and perceived usefulness and ease-of-use based on Davis’s (1989) technology acceptance model (TAM). The use of different sets of predictors makes it hard to reconcile the findings. Also, leaving out important variables leads to incomplete results that lessen the value of a study in terms of its theoretical and practical implications. Therefore, a higher-level analytical framework is needed to organize the variables from different studies together for the systematic investigation of the factors that influence SaaS adoption.

2.2. Technology–organization–environment framework

Tornatzky et al.’s (1990) technology–organization–environment (TOE) framework is appropriate for this purpose. It emphasizes the role that contextual factors play in the process of innovation adoption, and classifies them into three categories: technology on the innovation side, organization on the adopter side, and environment in which adoption occurs. Unlike most other theories and models in the information systems field, the TOE framework is a generic theory that only suggests different sources of influence without specifying the variables in each (Zhu & Kraemer, 2005). Researchers may choose different technological, organizational and environmental factors for different IT innovations, making TOE framework highly adaptable and broadly applicable (Baker, 2012).

Despite its flexibility, the TOE framework is built upon a solid theoretical foundation and consistently supported by empirical results (Oliveira & Martins, 2011). To the best knowledge of the authors, however, the TOE framework has not yet been used in the investigation of SaaS adoption. Based on the TOE framework, Table 1 classified the significant variables identified in previous empirical studies on enterprise adoption of SaaS and cloud computing. General variables such as uncertainties and impacts are not included because they can be related to more than one category. Variables that are conceptually similar are combined.

There are more variables and studies in the technology and organization categories than the environment category. This is consistent with what other researchers have found in IT innovation adoption studies using the TOE framework (Yoon & George, 2013). Yet, does it mean that environmental factors are not as important as the technological and organizational factors? Questions like this are interesting to both researchers and practitioners who want to find out what make more differences in SaaS adoption. The TOE framework, rather than offering competitive explanations to existing theories, is able to integrate different types of variables into a holistic model (Oliveira & Martins, 2011). This makes it possible to compare the effects of different factors on SaaS adoption, leading to the insights on organizations’ primary concerns about SaaS.

3. Research model

The TOE framework presumes the importance of all three types of factors related to technology, organization and environment to innovation adoption. Yet it is up to researchers to select variables and specify relationships. Most of the existing studies that adopt this framework examine the effects of different types of factors on technology adoption separately (Low et al., 2011). Such individual modeling of relationships, however, does not reflect the basic premise of the TOE framework that different sources of influences need to be examined together.

To integrate the impacts of technological, organizational and environmental factors on SaaS adoption, there is a need for a formative construct that captures their overall effect. Compared with general considerations such as cost and security, these three types of factors make differences in how people are prepared and willing to adopt the innovation, or “SaaS Readiness”. That is, potential users in different organizations have different considerations related to technology, organization and environment, which largely determine how ready they are to adopt SaaS.

Researchers have adopted behavioral models to study user adoption of IT, and the most influential is the aforementioned TAM which is based on the Theory of Reasoned Action (Fishbein & Ajzen, 1975). Most technology adoption studies are based on TAM and derived models, such as the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). The main TAM constructs include perceived usefulness and perceived ease-of-use to predict behavioral intention.

The adoption of IT innovations like SaaS and cloud-computing involves the considerations more than user perceptions of the technologies. Organizational factors such as IT assets/capabilities/resources may be more prominent in adoption decision-making (Bharadwaj, 2000). In addition, SaaS allows organizations to outsource their IT applications, and a provider may serve hundreds or even thousands organizations at the same time. Compared with the traditional in-house model, the new IT service delivery model makes it possible for business partners to process and share transactional data on a common IT platform. Thus, SaaS adoption must
consider external environment in addition to technology and organization.

The central hypothesis of this study is that technological, organizational and environmental readiness factors are all essential for the adoption of SaaS. If organizational users are not ready in any one aspect, they may become hesitant to adopt the innovation. Thus, this study proposes a tripod model of SaaS Readiness shown in Fig. 1.

In the model, SaaS Readiness comprises three components, technological readiness, organizational readiness and environmental readiness, each of which is contributed by its own indicators. Thus, it is a type of higher-order model in which both first-order and second-order constructs are formative (Polites, Roberts, & Thatcher, 2012). The psychological dependent variables of SaaS Readiness include the Attitude toward SaaS and Intention to Use SaaS. Attitude and intention are two common outcome variables in technology adoption literature (e.g. Davis, 1989). The model reflects the underlying premise of the TOE framework that for an organization to adopt the innovation, relevant users need to get ready in all three aspects.

SaaS readiness indicators need to be selected from relevant technological, organizational and environmental factors pertinent to SaaS adoption. Most of the factors identified from the literature review are used to study the adoption of cloud computing. Though SaaS is closely related to cloud computing, the former is a service delivery model at the application level and the latter is the enabling technology at the infrastructure level (Catteddu & Hogben, 2009). The findings of existing studies about cloud-computing adoption may not be directly applicable to the context of SaaS adoption. Thus, broader innovation adoption literature is consulted.

From the social-technical perspective, the adoption of an IT innovation in organizations is a phenomenon comprising the interactions between individual users and the technology in certain social contexts (Averrous, 2003; Kwak & Ahn, 2010). The settings in which cloud-based applications are used may make differences in user psychological and overt behavior (Jou & Wang, 2013; Lin, Wen, Jou, & Wu, 2014). The main criterion of variable selection for SaaS readiness, therefore, is that all of them be operationalized as the situated perceptions of organizational users. This is congruent with the research route to combine TOE framework with theories of individual behavior for the explanation of organizational adoption (Baker, 2012). Some higher-level variables such as government policy are relevant to SaaS adoption, but they are not organization-specific and should not be included.

### 3.1. Technological readiness

Technological readiness refers to how organizational users are prepared and willing to adopt SaaS based on the perceived features of the technology. In previous studies on technology acceptance, researchers have developed a similar concept “technology readiness” to capture user openness to new information technologies, but their operationalization mainly focuses on user personality and technology usability aspects (Parasuraman, 2000; Walczuch, Lemmink, & Streukens, 2007). Compared with traditional individual applications, SaaS provides a platform for organizational users to share software across physical and managerial boundaries. For such interoperable systems, the content domain of technological readiness should be broader (Park, Rhoads, Hou, & Lee, 2014).

According to Rogers’ (1995) Innovation Diffusion Theory (IDT), there are several intrinsic characteristics of an innovation that influence its diffusion: (1) Relative Advantage: how improved an innovation is over the previous generation; (2) Simplicity (or complexity): whether an innovation is easy or difficult to use; (3) Compatibility: whether an innovation is compatible with current practices, values, and needs; (4) Trialability: how easily an innovation may be experimented and test-run; and (5) Observability: the

### Table 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Relative advantage (Lin &amp; Chen, 2012; Low et al., 2011; Wu, 2011)</td>
</tr>
<tr>
<td></td>
<td>Ease of use (Wu, 2011)</td>
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<td></td>
<td>Security concern (Bentiam, Koufaris, &amp; Hess, 2011; Wu, 2011)</td>
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<td></td>
<td>Compatibility (Lin &amp; Chen, 2012)</td>
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<td></td>
<td>Trialability/observability (Kendall et al., 2001; Kolodinsky et al., 2004; Moore &amp; Benbasat, 1991)</td>
</tr>
<tr>
<td>Organization</td>
<td>Top management support (Low et al., 2011)</td>
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<td></td>
<td>Organization size (Low et al., 2011)</td>
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<td></td>
<td>Business needs (Ratten, 2012; Lin &amp; Chen, 2012)</td>
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<tr>
<td></td>
<td>Expertise (Ratten, 2012)</td>
</tr>
<tr>
<td>Environment</td>
<td>Competitor pressure (Low et al., 2011)</td>
</tr>
<tr>
<td></td>
<td>Partner pressure (Low et al., 2011)</td>
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![Fig. 1. Tripod model of SaaS Readiness.](image-url)
extent to which the effectiveness of an innovation is visible. IDT gives a comprehensive conceptual framework for the understanding of innovation diffusion, but it does not directly provide a model that can be empirically tested.

First of all, organizational users need to find out how simple the solution is and judge this new technology's potential benefits (Lin & Chen, 2012). Thus Relative Advantage and Simplicity are closely related to SaaS adoption. They are similar to the perceived usefulness and perceived ease-of-use of TAM, but more appropriate for the study of innovation adoption than application adoption (Moore & Benbasat, 1991).

Their relationships with technological readiness are hypothesized as follows:

**H1a.** Relative Advantage positively contributes to Technological Readiness.

**H1b.** Simplicity positively contributes to Technological Readiness.

**H1c.** Compatibility positively contributes to Technological Readiness.

A considerable number of studies have shown that the compatibility with existing technologies and practices is an important factor affecting the adoption of a new technology (Lin & Chen, 2012; Ramamurthy, Premkumar, & Crum, 1999; Wang, Wang, & Yang, 2010). The results of Infonetics Research 2009 survey indicated that 82 percent of respondents planned to replace their existing IT deployments with the adoption of SaaS solutions, instead of replacing them (Wilson, 2009). Bernard (2011) also found that organizations need to assess the managerial inconsistency between cloud-based services and existing systems as a risk. If a SaaS solution is largely compatible with the current processes, organizational users are likely to adopt the innovation. Here is the next hypothesis:

**H1d.** Experienceability positively contributes to Technological Readiness.

Comprising relative advantage, simplicity, compatibility and experienceability, technological readiness is one of the major components of SaaS Readiness. At a higher level, the relationship between technological readiness and overall SaaS Readiness is presented in the second-order hypothesis as below:

**H1.** Technological Readiness positively contributes to SaaS Readiness.

### 3.2. Organizational readiness

In addition to the perceived characteristics of SaaS solution, how ready potential users are to adopt it in their work depends on the internal and external factors related to the organization in question. In the area of e-commerce adoption, researchers categorize them into perceived organizational e-readiness (POER) and perceived environmental e-readiness (PEER) respectively (Hung, Chang, Lin, & Hsiao, 2014; Molla & Licker, 2005). This study adapts those concepts in the context of SaaS adoption. Organizational readiness refers to how employees are prepared and willing to adopt SaaS based on the perceived capability of the organization to absorb the innovation. IT infrastructure and top management support are the two organizational factors often mentioned in technology adoption literature.

IT infrastructure is essential for an organization to adopt new applications as it provides necessary hardware platform, supporting software, computer network, and physical facilities (Grover, 1993; Oliveira & Martins, 2010; Zhu, Kraemer, & Dedrick, 2004). Thus, IT infrastructure reflects the capability to implement and operate information systems, and is an important component of organizational competitiveness (Lee & Shim, 2007). The more mature an IT infrastructure is, the easier it is for an organization to adopt SaaS to improve business performance (Xin & Levina, 2008). This leads to the following hypothesis:

**H2a.** IT Infrastructure positively contributes to Organizational Readiness.

Top management support for the adoption of an technology is especially important for small and medium enterprises in which chief executive officers (CEOs) or equivalent typically have the final say on organizational IT strategy and investment (Bradford & Florin, 2003). For most of such businesses, the transition from the traditional in-house IT operation to the new cloud-computing model is a strategic decision. If the executives understand SaaS and hold positive attitudes toward the innovation, they are likely to make decisions in favor of its adoption. In addition to the adoption decision itself, the degree of support from the executives also largely determines the extent to which the cloud-based applications are to be used (Low et al., 2011). Hence the next hypothesis:

**H2b.** Top Management Support positively contributes to Organizational Readiness.

Therefore, organizational readiness is a first-order formative construct comprising IT infrastructure and top management support. Like technological readiness, it is another pillar contributing to the formation of SaaS readiness at the higher level.

**H2.** Organizational Readiness positively contributes to SaaS Readiness.
3.3. Environmental readiness

Even when there is a fit between an organization and a SaaS solution, the adoption may still encounter strong resistance due to inhibiting factors such as incumbent system habits, switching costs or simply inertia against changes (Politès & Karahanna, 2012). To overcome such reluctance, certain environmental conditions, especially those related to business partners and competitors, are needed to push decision-making forward (Soliman & Janz, 2004). Environmental readiness refers to how organizational users are prepared and willing to adopt SaaS due to the perceived pressures from outside.

Many empirical studies have shown that competitor pressure is a driving factor for the diffusion of information technologies (Benbasat & Dexter, 1995; Grover, 1993; Low et al., 2011; Ramamurthy et al., 1999; Zhu et al., 2004). If more and more competitors begin to adopt SaaS to enjoy its benefits, the decision makers in an organization are likely to feel the pressure to do the same in order to retain competitive advantage. Here is the next hypothesis:

H3a. Competitor Pressure positively contributes to Environmental Readiness.

In addition to the pressure from competitors on SaaS adoption, the pressure from business partners may also be imposing. Partner pressure to adopt SaaS may be present as it provides a platform for IT-enabled collaboration, such as the supply chain management among suppliers, manufacturers, wholesalers and retailers. Numerous studies have shown that such a demand from business partners is an important factor affecting the adoption and use of IT applications (Benbasat & Dexter, 1995; Bradford & Florin, 2003; Chong & Ooi, 2008; Grover, 1993; Low et al., 2011; Oliveira & Martins, 2010; Wang et al., 2010; Zhu et al., 2004). The collaboration among modern organizations requires users to consider the need of information exchange with their business partners.

H3b. Partner Pressure positively contributes to Environmental Readiness.

As a major component of SaaS Readiness, environmental readiness is shaped primarily by competitor pressure and partner pressure. In the tripod model, environmental readiness provides an important support to SaaS adoption together with the other two pillars, technological readiness and organizational readiness.

H3. Environmental Readiness positively contributes to SaaS Readiness.

3.4. SaaS Readiness outcomes

Innovation adoption in an organization is a process involving not only pre-adoption decision-making but also post-adoption technology usage. Organizations typically make two types of adoption decisions: collective innovation decisions based on the consensus among the members of an organization and authority innovation decisions made by a few powerful individuals within an organization (Rogers, 1995). Even an authority decision needs to take the opinions of organizational users into account or they may “circumvent” it during and after the implementation of the innovation in question, as it is still up to them on how to use it (e.g. at a minimum or spontaneously) (Rogers, 2003, p. 29). Thus SaaS adoption is a phenomenon concerning both individual dispositions and organizational decisions.

Accordingly, the outcomes of SaaS Readiness can be categorized into two types: psychological outcome at the individual level and overt outcome at the organizational level. The common psychological outcome variables in the technology adoption literature include attitude toward a technology and intention to use a technology (Venkatesh et al., 2003). They are often used in empirical studies as they can be measured with psychometric instruments, just like their antecedents. The following two hypotheses are proposed:

H4a. SaaS Readiness positively affects Attitude toward SaaS.

H4b. SaaS Readiness positively affects Intention to Use SaaS.

This study also includes SaaS adoption decision, or whether an organization has decided to adopt SaaS, as another dependent variable of SaaS Readiness. The inclusion of such an overt outcome in analyses allows further validation of the tripod model of SaaS Readiness. Unlike psychological outcomes such as attitude and intention, this overt outcome is dichotomous in nature, and cannot be included in the same path model. Rather, the component scores of technological readiness, organizational readiness and environmental readiness are to be used to predict this dependent variable directly. In this way, the modeling does not involve specific individual perceptions (e.g. perceived relative advantage and top management support). The underlying assumption is that most organizations are hesitant to adopt an IT innovation unless their employees are ready, whether the decisions are collective or authoritative (Rogers, 2003). Thus a separate set of hypotheses, each on the relationship between a SaaS Readiness component and SaaS adoption decision, are to be tested with a different statistical method:

H5a. Technological readiness positively affects SaaS adoption decision.

H5b. Organizational readiness positively affects SaaS adoption decision.

H5c. Environmental readiness positively affects SaaS adoption decision.

4. Methodology

4.1. Measurement

The components of technological readiness for SaaS adoption, including relative advantage, simplicity, compatibility, and experienceability, are based on the innovation diffusion theory (IDT). However, Rogers (2003) did not operationalize the constructs by himself as IDT is a general theory for all types of innovations. Thus, this study measures them with the instruments adapted from relevant empirical studies on IT innovations.

Because of the close relationships between relative advantage and perceived usefulness and between simplicity and perceived ease-of-use in information systems research (Venkatesh et al., 2003), relative advantage and simplicity measures are adapted from the perceived usefulness and perceived ease-of-use measures respectively in Venkatesh and Davis’s (1996, 2000) study as Moore and Benbasat (1991) did in their study.

Similarly, compatibility is measured with the instrument developed and validated by Wu and Wang (2005) and Wang et al. (2010). Experienceability is measured with three items adapted
from multiple studies to measure trialability and observability (Kendall, Tung, Chua, Ng, & Tan, 2001; Kolodinsky, Hogarth, & Hilgert, 2004; Moore & Benbasat, 1991).

The organizational readiness for SaaS adoption comprises IT infrastructure and top management support. The measurement instrument of IT infrastructure was adapted from Wang et al.'s (2010) relevant measures. Top management support was also measured by the items developed and validated by Wang et al. (2010).

Competitor pressure and partner pressure are the two components of the environmental readiness for SaaS adoption. The measures of competitor pressure comprise three items adapted from Wang et al.'s study (2010). Partner pressure was measured with the instrument developed and validated by Taylor and Todd (1995) and Wang et al. (2010).

The outcome variables of SaaS Readiness include attitude toward SaaS, intention to use SaaS and actual adoption decision. Attitude toward SaaS was measured with the scale adapted from Taylor and Todd (1995) and Bhattacharjee’s (2000) study. The items of intention to use SaaS were adapted from those used in Taylor and Todd (1995) and Venkatesh and Davis’ (2000) studies. Finally, the actual adoption decision was measured with a single item asking whether an organization has made the decision to adopt SaaS or not.

The measurement items were translated into Chinese. To ensure that the translated versions do not deviate from the original English versions, the items in Chinese were translated back into the items in English by an independent translator. Two English versions were reviewed by several people whose native language is English. They agreed that the meanings are consistent between two versions. This suggests that the translated version is quite accurate.

4.2. Study design

The diffusion of SaaS around the globe is far from even because country-specific factors such as telecommunication infrastructure and IT-related education may impose critical constraints (Gartner, 2012). To avoid the confounding effects of these country-level factors with SaaS Readiness components, this study will focus on SaaS adoption in a single country. In China, more and more organizations, especially small and medium-sized enterprises, begin to accept SaaS as a viable IT solution. Compared with other developing countries, the influence of aforementioned constraints is less prominent. Compared with developed countries, on the other hand, most of organizations in China are relatively young and their IT development just took off within the last two decades. Unlike many older organizations that are still running legacy systems, they are less concerned about the transition cost. When organizational resistance is not as strong, the effects of SaaS Readiness components are more likely to manifest themselves in innovation adoption.

The target population of this study comprises the organizational users of SaaS in both private and public sectors. Based on the contact information compiled in the business catalogs, observations were collected from the organizations in several big cities (i.e. Beijing, Shanghai, and Xi’an) across different regions. Before the survey, the research team contacted the IT managers and IT staff of the organizations in the sample. Then they visited them in person and conducted the survey on site. In order to enhance the response rate, the participants were ensured of the anonymity of responses and the sole purpose of non-commercial research. Compared with mail-in survey, the on-site interview approach typically results in higher response rate.

4.3. Sample

To make sure that the sample size is sufficient to test the hypothesized relationships, we follow the recommendation by Hair et al. (2013, p. 21, Exhibit 1.7). They gave a sample size recommendation in a partial least square analysis for a statistical power of 80%. In our structural model, the maximum number of arrows pointing at a construct is 4 (i.e. Technological Readiness). We would need at least 65 observations to achieve a statistical power of 80% for detecting the minimum effect size of 0.25 R-square with a 5% probability of error. Even for the most conservative effect size of 0.1 R-square, the sample size needed is 137. In addition, the factor analysis for measurement validation requires a minimum 100 observations, and preferably 5 observations per measure (MacCallum, Widaman, Zhang, & Hong, 1999). There are altogether 36 measures, and it is preferred to have around 180 observations. Thus, around 200 companies were visited and among them 173 responded. Table 2 reports their profiles.

The generalizability of findings from an IT behavioral study largely depends on whether the sampling frame represents different organizations and users in the target population (Lee & Baskerville, 2003). As the profiles indicate, the organizations in the sample had different SaaS adoption status, and varied in size and background. Among the 173 organizations in the sample, almost 40% already adopted SaaS, 10% decided to do so, and the rest did not have the plan yet. About three quarters were small or medium organizations that had fewer than 250 employees, and the other quarter comprised relatively big organizations that have more than 250 employees. About half of the organizations were private companies, and the others were public companies, state-owned enterprises, and not-for-profit organizations. They struck a balance between private and public sectors, and the proportion of each category was largely consistent with the national figure. Among the respondents, about 30% were IT directors and executives (CIO or CEO), about 40% were middle-level IT managers, and the rest were IT technicians. Consistent with the gender distribution in the IT industry, the number of male respondents almost doubled that of females.

5. Results

Table 3 gives the results of measurement validity assessment. The fit indices of confirmatory factor analysis indicated that the
model fit was acceptable considering the large number of variables in the model (Chi-square = 1047.292; model df = 549; chi-square/df = 1.908; RMSEA = 0.073; CFI = 0.844). All factor loadings were well above 0.5, and composite reliability (CR) coefficients were above 0.7. The overall average variance extracted (AVE) was 0.56, above the 0.5 threshold. They indicate acceptable convergent validity. Except for the correlation between Attitude toward SaaS and Intention to Use SaaS (i.e. 0.828), all the other correlations among constructs were below 0.7. The fact that SaaS Readiness constructs were not highly correlated with each other supports discriminant validity. Both convergent validity and discriminant validity justify the calculation of index score for each construct by taking the average of its indicators. Such a practice of item parceling simplifies statistical modeling and enhances the accuracy of parameter estimates (Hall, Snell, & Foust, 1999).

Table 3 also reports the descriptive statistics of index scores for the examination of response patterns. All psychometric variables exhibited good dispersions of responses in terms of standard deviations (SD) between 0.6 and 0.8. On average, the responses to most of the variables were quite positive, except for the means of Compatibility, Competitor Pressure, and Partner Pressure that were somewhat close to the neutral point. Around half of the organizations in the sample had made the decision to adopt SaaS.

Unlike a reflective latent variable, a formative latent variable does not require its indicators to be homogeneous; rather, they should be quite independent from each other (Vinzi, Trinchera, & Amato, 2010). To examine the distinctiveness among the formative indicators of each latent variable in the research model, their degrees of collinearity were assessed at different levels. As shown in Table 4, all the variance inflation factors (VIF) were below the threshold of two, suggesting that the formative indicators can be considered independent from each other. At the first-order level, only the VIFs of Relative Advantage and Simplicity were a little bit above 1.5. As previously mentioned, they are two closely-related indicators of Technological Readiness. At the second-order level, all VIFs were below 1.5 for the three SaaS Readiness components.

The next step is to test the research hypotheses regarding the relationships between SaaS readiness components and psychological outcomes in terms of intention and attitude. As technological readiness, organizational readiness and environmental readiness are formative latent variables, the analysis employs partial least square (PLS) method as it is more capable of handling formative constructs than traditional covariance-based SEM (Petter, Straub, & Rai, 2007). Table 5 shows the results of PLS analysis on the research model. The coefficient of determination (i.e. R-square) of the endogenous latent variable SaaS Readiness was 0.397, indicating that about 40% of its variation was explained. The well-established TAM and related models typically explained between 30% and 40% of the variation in the dependent variable (Venkatesh et al., 2003). Thus, the tripod model of SaaS Readiness exhibits an acceptable explanatory power of SaaS adoption in terms of its psychological outcome.

Table 4

<table>
<thead>
<tr>
<th>Formative indicator</th>
<th>Tolerance</th>
<th>VIF</th>
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<tbody>
<tr>
<td>Technological Readiness</td>
<td>.689</td>
<td>1.451</td>
</tr>
<tr>
<td>– Relative advantage</td>
<td>.617</td>
<td>1.622</td>
</tr>
<tr>
<td>– Simplicity</td>
<td>.586</td>
<td>1.707</td>
</tr>
<tr>
<td>– Compatibility</td>
<td>.795</td>
<td>1.257</td>
</tr>
<tr>
<td>– Experienceability</td>
<td>.747</td>
<td>1.338</td>
</tr>
<tr>
<td>Organizational Readiness</td>
<td>.669</td>
<td>1.495</td>
</tr>
<tr>
<td>– IT infrastructure</td>
<td>.976</td>
<td>1.024</td>
</tr>
<tr>
<td>– Top management support</td>
<td>.976</td>
<td>1.024</td>
</tr>
<tr>
<td>Environmental Readiness</td>
<td>.798</td>
<td>1.254</td>
</tr>
<tr>
<td>– Competitor pressure</td>
<td>.710</td>
<td>1.408</td>
</tr>
<tr>
<td>– Partner pressure</td>
<td>.710</td>
<td>1.408</td>
</tr>
</tbody>
</table>

Fig. 2 shows the estimated model. All the four components of Technological Readiness were significant, yet Compatibility was more salient than the others. Between the two components of Organizational Readiness, Top Management Support was much more important than IT infrastructure. On the other hand, both Competitor Pressure and Partner Pressure were important components of Environmental Readiness. In this study, Competitor Pressure was a little bit more salient than the Partner Pressure. Among the three aspects of SaaS Readiness, Technological Readiness was the most salient, and Organizational Readiness was the least, with Environmental Readiness in between. Finally, SaaS Readiness had significant effects on both psychological outcome variables, Attitude toward SaaS and Intention to Use SaaS.

To assess the predictive validity of SaaS readiness in terms of overt outcome in addition to psychological outcome, a logistic regression analysis was then conducted to predict the actual SaaS adoption decision with technological readiness, organizational readiness and environmental readiness. Each component score was the weighted average calculated using the regression weights of its indicators obtained from the PLS analysis. Table 6 reports the results. The overall model was highly significant as indicated by the log likelihood and chi-square statistic. The Hosmer and Lemeshow test was not significant ($\chi^2 = 14.61, df = 8, p = 0.067$), indicating that the model fit is acceptable (i.e. the classification result does not deviate significantly from that of the ideal model). The Nagelkerke R-Square was .326, and the overall percentage of correct classification was 71.7%, a significant lift from the rate of random choice 51.4%. All the three components of SaaS Readiness were important in predicting whether organizations were to implement SaaS. This time, Organizational Readiness was the most significant, and Technological Readiness was instead the least, with Environmental Readiness again in between.

As an organizational innovation, SaaS adoption decision-making may be related to the characteristics of an organization. In particular, the relationships between SaaS Readiness components and outcome variables may vary across organizations of different types and sizes. To find out whether it is the case, Type and Size were included as control variables in research model. As shown in Table 7, each analysis tests the direct effect of a control variable as well as its interaction effects with technological, organizational and environmental components on SaaS Readiness. None of the effects were significant as all the t statistics of regression coefficients were below 2, indicating that organizational characteristics did not make big differences in the hypothesized relationships. Nevertheless, the interaction effect between type and environmental readiness was marginally significant (t-statistic close to 2), suggesting that the private and non-private organizations may respond to partner and competitor pressures somewhat differently in SaaS adoption decision-making.
6. Discussion

In addition to organizational characteristics, participant characteristics, especially positions, may also deserve a close look as control variables. Yet, the positions of CEO/CIO, IT Director, IT manager and IT technician in the sample are hard to be grouped into two levels to create a dummy variable. An alternative is to do a multi-group analysis and compare the relationships across the four positions. However, the sample size of CEOs/CIOs is too small to make such an analysis feasible. This is a major limitation of this study as CEOs/CIOs may have very different considerations, such as investment and financial performance, regarding SaaS adoption compared with others. Though they are outnumbered by IT personnel, they play critical roles in SaaS adoption decision making. It is not a bias issue however, as all the responses were anonymous and participants should not be too concerned about how their personal beliefs may be viewed by others. In future studies, therefore, more observations need to be collected from CEOs/CIOs. Another limitation is that all observations were collected from a single country. China is somewhat unique as it is the largest growing
economy in the world. Thus, the results may not be generalizable to other countries. This points to another direction for future research to collect observations from multiple countries, preferably at different development stages and of different cultural backgrounds.

Despite the limitations, this study yields some important findings. One interesting result is that different SaaS Readiness components predict psychological and overt outcome variables in different ways. For the psychological outcome variables (i.e., Attitude toward SaaS and Intention to Use SaaS), Technological Readiness was the most significant and Organizational Readiness was the least. However, for the overt outcome variable (i.e., actual adoption decision), it was the opposite: Technological Readiness was the least significant but the Organizational Readiness was the most.

The result suggests that stakeholders have different considerations regarding SaaS adoption at different stages. For SaaS adoption decision-making, organizational users are more concerned about organizational and environmental readiness. In particular, top management support and competitor pressure seem to be particularly important. For the behavioral intention to actually use SaaS in work, organizational users are more concerned about technological characteristics of innovation itself, such as usability.

Compatibility plays a significant role in the formation of technological readiness. It is more important than other common variables in technology adoption literature, such as perceived usefulness (or relative advantage) and perceived ease-of-use (or simplicity). This shows the uniqueness of SaaS as an organizational innovation. Compared with traditional in-house IT solutions, decision-makers and potential users care more about how well a SaaS solution can handle existing business processes and how smooth the transition will be. Among the factors of technological readiness, compatibility is closely related to the existing procedures and structures of organizations. The result suggests that the perceived compatibility of SaaS plays an important role in organization-level decision-making as well as individual-level usage.

As for Organizational Readiness, IT infrastructure was found insignificant. This is not totally surprising because SaaS does not require IT infrastructure as much as in-house solutions. Actually, the lack of IT infrastructure can be a motive to outsource IT services. On the other hand, the Innovation Diffusion Theory suggests that IT infrastructure has a positive effect on innovation adoption (Rogers, 1995). The insignificant effect of IT infrastructure, therefore, may be due to the cancelling-out of two opposite influences. Compared with IT infrastructure, top management support is more critical: a champion at the executive level is the key to successful SaaS adoption for organizational users.

The environmental readiness is found important for both psychological and overt outcome variables. Partner pressure and competitor pressure are consistently the pushing forces behind SaaS adoption. This reflects another unique aspect of SaaS innovation: it is not an IT solution limited to each organization, but involving a network of organizations. In this study, the competitor pressure was found more significant than partner pressure. The majority of organizations in the sample had fewer than 250 employees. Thus competitive pressure seems to be somewhat more important than partner pressure for small and medium organizations in China when they make decisions regarding SaaS adoption.

7. Conclusion and Implications

Based on the literature review and TOE framework, this study proposes a tripod model of SaaS Readiness. It hypothesizes that for organizational users to adopt SaaS, they need to get ready from technological, organizational and environmental aspects. The empirical results suggest that all three components of SaaS Readiness are indispensable for both psychological and overt outcomes. The findings provide researchers and practitioners some insights on the relative importance of each type of factors to SaaS adoption at different stages.

The primary contribution of this study is that it extends the TOE framework by using formative constructs at different levels to capture the psychological impacts of technological, organizational and environmental factors on SaaS adoption. This study uses all perceptual constructs of which the effects can be aggregated as the formative indicators of technological readiness, organizational readiness and environmental readiness. At different levels, the hierarchical modeling approach structures the relationships among different types of factors. Thus the tripod model of SaaS Readiness reflects the spirit of TOE framework that the three aspects of influences are not independent from but closely related to each other.

The tripod model makes it possible to assess and compare the effects of the technological, organizational and environmental components of SaaS Readiness on adoption outcomes. Most existing studies based on the TOE framework examine their effects separately. With the tripod model, researchers and practitioners may directly compare the effects and find out the relative importance of each aspect of influence to SaaS adoption.

The comparison of the effects of technological readiness, organizational readiness and environmental readiness on different types of outcome variables yields interesting insights as aforementioned. They provide some useful hints on how to promote the diffusion of SaaS. In addition to presenting technical features, it is essential to allow users to have first-hand experiences with a solution. Thus, the sales teams of SaaS providers need to do more than just demonstrating how fast, stable and secure their solutions are, as for traditional IT products. It is also important to provide potential customers the opportunities to try out the solutions and provide necessary service support. Directly strengthening the experienceability of SaaS innovation, this practice also enhances their perceptions of relative advantage and simplicity.

In addition, compatibility is the key to SaaS Readiness. To enhance the compatibility of SaaS solutions, providers may tailor them to the needs of individual customers. In fact, two leading CRM SaaS solution providers, one in China (800APPs.com., 2013) and the other in the world (Salesforce.com., 2013), found that the best-selling solutions are “enterprise editions” that are customized for individual organizations. SaaS providers need to understand the existing business processes, IT infrastructures, and organizational cultures in order to tailor the solutions to customer needs. This may assure organizational users of the value of SaaS solutions in enhancing the competitive advantage of their organizations, and relieve their concerns on tangible and intangible transition costs.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.chb.2014.12.022.

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