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Abstract

The goal of this study is to discover the technological, organizational, and environmental determinants for Software as a Service (SaaS) adoption in Indonesian companies. The technological-organizational-environmental (TOE) framework was adopted as a primary theoretical lens, combined with five innovation characteristics of Diffusion of Innovation (DOI) theory, which incorporated in technological context of the framework. We used a questionnaire to collect data from 147 of Indonesian companies. A logistic regression was carried out to test our hypotheses. The results confirmed that compatibility, observability, market competition, and government have positive relationship with SaaS adoption in Indonesian, while complexity found to be the negative determinant to its adoption. We also found that the organizational context of TOE framework did not contribute to the prediction of SaaS adoption in Indonesian companies. The findings offer valuable insights for researchers of SaaS and innovation adoption, for Indonesian policy makers that want to encourage SaaS adoption, as well as for SaaS vendors that want to develop strategies to persuade companies in Indonesia to adopt SaaS.

Keywords: Software-as-a-Service, Adoption, Indonesia, TOE Framework, DoI Theory

1   INTRODUCTION

One of the most significant trends in the Information Technology (IT) industry in the last decade is the transformation from packaged software or on-premise software to subscription software services or on-demand software (Kaplan, 2005), which is currently known as "Software as a Service" (SaaS). Kaplan (2005) argues that the movement to SaaS was triggered by the combination of customer frustration with traditional software applications and the technological possibility to deliver robust software functionality through the Internet. In the pure form of SaaS, a provider hosts an application centrally and delivers access to multiple customers over the Internet as a service and thus, eliminates the need to install and run the software on the customers' computer (Marston et al., 2011; Sultan, 2010). Consequently, customers merely pay for a fee based on their usage, since there are no licensing fees (Wu et al., 2011; Chong & Carraro, 2006). With SaaS, the job of deploying an application and keeping it running from day to day is the responsibility of the provider. This unique feature allows the SaaS market to grow six times faster than the traditional software market (Lee et al., 2013; IDC, 2009). Since its emergence little of a decade ago, SaaS has become widely accepted in many countries.

The rise of SaaS has attracted much interest from researchers who seek to obtain a better understanding on this innovation, either from a technical perspective (i.e., Lee et al., 2011; Kong et al., 2010; La & Kim, 2009), or from a business perspective (i.e., Kulkarni et al.,2012; Marstson et al., 2011; Harmon et al., 2009). Studies on SaaS have found the drivers and inhibitors of SaaS adoption in organizational contexts (i.e., Lee et al., 2013; Lechesa et al., 2012; Benlian & Buxmann, 2009). However, some factors, which might seem unimportant as the drivers of SaaS adoption in one country, may play a crucial role in other countries, and the other way around. For example, Benlian & Hess (2011), found that the major triggering factor of SaaS adoption in developed countries is cost advantages, while Madisha & Belle (2011) found that. in developing countries it is the awareness level of SaaS. These variations of SaaS adoption factors create different levels of its adoption throughout different countries (Valente & Mitra, 2007; Waters, 2005).

In the Information System (IS) literature, innovation and diffusion have been extensively studied (Ramdani & Kawalek, 2007; Venkatesh et al., 2003). Theories and models have been proposed to explain the innovation and diffusion process, such as the Technology Acceptance Model (Davis, 1989), Theory of Reasoned Action (Fishbein, 1979), and,Theory of Planned Behavior (Ajzen, 1991), and Rogers' Diffusion of Innovation theory (Rogers, 1995). The latter one has been frequently employed to investigate drivers of innovation adoption (i.e., Lin & Chen, 2012; Wu et al., 2011), since it can be used in individual perspective (i.e., Brown et al., 2003) as well as in organizational perspective (i.e., Azam & Quaddus, 2009). Meanwhile, the first three can only be used in individual perspective (Venkatesh et al., 2003). As an addition to these theories, the TOE (technological-organizational-environment) framework has been developed by Tornatzky and Fleicher (1990), which explained that the adoption decision of an innovation is based on factors in the organizational and external environment, as well as characteristic of the innovation itself (Lai et al., 2010; Kuan & Chau, 2001). This framework has received more attention and acceptance from diverse fields of study as it is consistent with Rogers' Diffusion of Innovation theory (Azam & Quaddus, 2009). However, it has not been extensively applied to the domain of SaaS adoption (Wu, et al., 2011).

According to the research conducted by Mangula et al. (2012), which investigated the current state of cloud business model adoption in Indonesia (Mangula et al., 2012), they showed that the level of cloud adoption in Indonesia remains at the early stage. Furthermore, we found that since 2006, few local cloud vendors have started to offer cloud services for Indonesian customers. Although the number of cloud vendors keeps increasing since then, these numbers seem still insufficient to catch up with the number of potential adopters of SaaS in Indonesia. Moreover, little is known about to what extent SaaS is actually adopted by end users. This paucity of exploration, as it turns out, leaves a significant gap in our understanding of SaaS adoption in Indonesia, and in a wider perspective, our understanding of SaaS adoption in developing countries. Encouraged by the issues identified above, we seek to study the following research question:

What are technological, organizational, and environmental determinants for the adoption of SaaS in Indonesian companies?

The rest of this paper is constructed as follows. Section 2 describes some of the existing research on innovation adoption in organizations, and the theories engaged to this research. In the next section, we outline the proposed research model of our study, in which consist of 12 predictors along with the tested hypotheses. How we built the survey instrument, how we collected the data, and how we extracted the data are provided in section 4. In section 5, we present our results, which are then discussed and compared the with the prior studies in section 6. Finally, we present concluding remarks and outline directions for future study in the last section.

2 ORGANIZATIONAL INNOVATION ADOPTION

Innovation can be defined as an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 1995). Research on IT innovation adoption is always be an interesting topic for IS scholars, since IT innovations are regarded as the enablers for improving organizations' competitiveness (Wu et al., 2011) and productivity (Oliveira & Martins, 2010), particularly viewed from an organizational perspective. The wide usage of IT innovations by individuals, groups and organizations has changed the way many people interact with each other (Azam & Quaddus, 2009).

Rogers' theory on Diffusion of Innovation (1995) has been widely applied in many studies to investigate individuals' or organizations' perceptions of innovation adoption and diffusion (Tan et al., 2009; Slyke et al., 2004; Kendall, 2001). Rogers found that the adoption of innovation will diffuse faster if it possesses five attributes of innovation including relative advantage, compatibility, complexity, trialability and observability. Lin & Chen (2012) showed in their research that these five attributes are the determinants that explain 49% to 87% of the variance in the rate of cloud computing adoption.

Consistent with Rogers' theory of innovation diffusion, Tornatzky and Fleischer (1999) formulated a technology-organization-environment (TOE) framework, which focuses on internal and external characteristics of organizations, as well as technological characteristics in explaining factors of innovation adoption in organizations (Ghobakhloo et al., 2011; Pudjianto et al., 2011; Oliveira & Martins, 2010). They argued that the threefold context proposed in this framework (technological context, organizational context and environmental context) might influence the organizations' perception either to adopt or to reject the IT innovation. This framework is suitable for investigating innovation adoption in an organization level (Alshamaila et al., 2013). The technological context describes both the existing technologies in use and emerging technologies that are relevant for the organization. Some of the characteristics of technology include the five attributes of Rogers' theory of innovation diffusion and additional factors, such as perceived of cost, and security. The organizational context refers to the characteristics of an organization such as firm size, top management support, and organization readiness. The environmental context relates to the surrounding elements in which an organization conducts its business, such as business partners, competitors, and government.

The TOE framework has been tested in a number of empirical studies on various IT innovations adoption, for example: electronic data interchange (EDI) (i.e., Kuan & Chau, 2001), Radio Frequency Identification adoption (i.e., Wang, et al., 2010), e-business (i.e., Oliveira & Martins, 2010; Zhu et al., 2006), e-commerce (i.e., Huy et al., 2012; Al Somali et al., 2012; Ghobakhloo et al., 2011), e-procurement (i.e., Teo et al., 2009), e-banking (i.e., Kurnia et al., 2010), and e-government (Pudjianto et al., 2011), and cloud computing adoption (Alshamaila et al., 2013; Wu et al., 2011). Empirical findings from these studies confirmed that the TOE framework provides a good starting point when analyzing and considering suitable factors for understanding the innovation adoption decision, since it has much empirical support (Wang et al., 2010). However, given that technology adoption is complex and context sensitive, different factors in the TOE framework may vary across different innovation, including amongst each type of cloud computing services (Baker, 2011). Therefore, even though there were some papers adopted TOE framework for investigating cloud computing adoption in general, this framework has not been utilized to the more specific domain of SaaS adoption.

3 RESEARCH MODEL AND HYPOTHESES

In this study, we used the three contexts of TOE framework (technological, organizational, and environmental context) as our primary theoretical lens, combined with the five innovation characteristics of DOI theory (relative advantage, compatibility, complexity, trialability, and observability), which are incorporated into the technological context of TOE framework. This framework is considered as an organization-level theory (Alshamaila et al., 2013). As illustrated in Figure 1, eleven factors are expected to have a positive contribution to SaaS adoption in Indonesia, and one factor is expected to have a inhibiting effect on SaaS adoption in Indonesia. In this study, SaaS adoption is defined in accordance with Rogers' DOI theory (1995) as adoption or rejection. Accordingly, adoption was considered as a decision by the Indonesian companies to adopt SaaS which was assigned the value of 1, and rejection was seen as the decision not to adopt SaaS which was assigned the value of 0.

3.1 Technological Context

In the original TOE framework, technological context is defined as characteristics of the technologies available for organizations, which can be those that are already in use at the organization, as well as those that are available in the marketplace but not currently adopted (Alshamaila et al., 2013).

Characteristics of innovation or technology suggested by Rogers' innovation diffusion theory (1995) were incorporated in this contextual in order to identify which characteristics acted as the influencers of the SaaS adoption in Indonesian companies.

Relative Advantage. Relative advantage is defined as the degree to which innovation is perceived by potential adopters as providing greater benefits than the current practices (Rogers, 1995). In other words, if a company perceives that the benefits of an innovation outweigh the risks, then the company tends to more likely to adopt it (Ghobakhloo et al., 2011; Wang et al., 2010; Lee, 2004). The expected benefits of SaaS adoption, such as cost reduction, access to the latest resources, rapid deployment, quality improvement, focus on core competencies, and easy maintenance (Lee et al., 2013; Lechesa et al., 2012; Benlian & Hess, 2011). Accordingly, the following hypothesis is stated:

> H1. *Relative advantage positively contributes to SaaS adoption in Indonesian companies.*

Compatibility. Compatibility has been confirmed as an essential factor for innovation adoption (Alshamaila et al., 2013; Ghobakhloo et al., 2011; Huy et al., 2012; Wang et al., 2010). Compatibility is defined as the degree to which innovation is perceived to be consistent with existing values, current needs, and previous experience of potential adopters (Rogers, 1995). Business owners or top management is more willing to adopt SaaS in their company if they perceive that SaaS adoption is compatible with the company's values, needs, and experience (Lee et al., 2004). Therefore, we hypothesize that:

> H2. *Compatibility positively contributes to SaaS adoption in Indonesian companies.*

Complexity. Rogers (1995) defined complexity as the extent to which an innovation is perceived as difficult to understand and use. In many recent studies, complexity has been proved to be a significant factor in the adoption decision (Huy et al., 2012; Lin & Chen, 2012; Wang et al., 2010). However, companies may not have confidence in SaaS because it is relatively new to them (Low et al., 2011), and it will take a long time to understand and implement it. Thus, complexity of an innovation can act as a barrier to implementation of new technology; complexity factor is usually negatively affected (Premkumar et al., 1994). This fact leads us to propose the following hypothesis:

> H3. *Complexity negatively contributes to SaaS adoption in Indonesian companies.*

Trialability. A number of studies revealed that trialability is considered as one of the most important components in the process of adopting an innovation (Alshamaila et al., 2013; Ramdani & Kawalek, 2007; Martins et al., 2004; Kendall, 2001). Trialability is the degree to which an innovation may be experimented with on a limited basis (Rogers, 1995). One of the ways to increase the probability of SaaS adoption in Indonesian companies is by allowing them to experience how SaaS works in a free-trial basis. Therefore, we suggested the following hypothesis:

> H4. *Trialability positively contributes to SaaS adoption in Indonesian companies.*
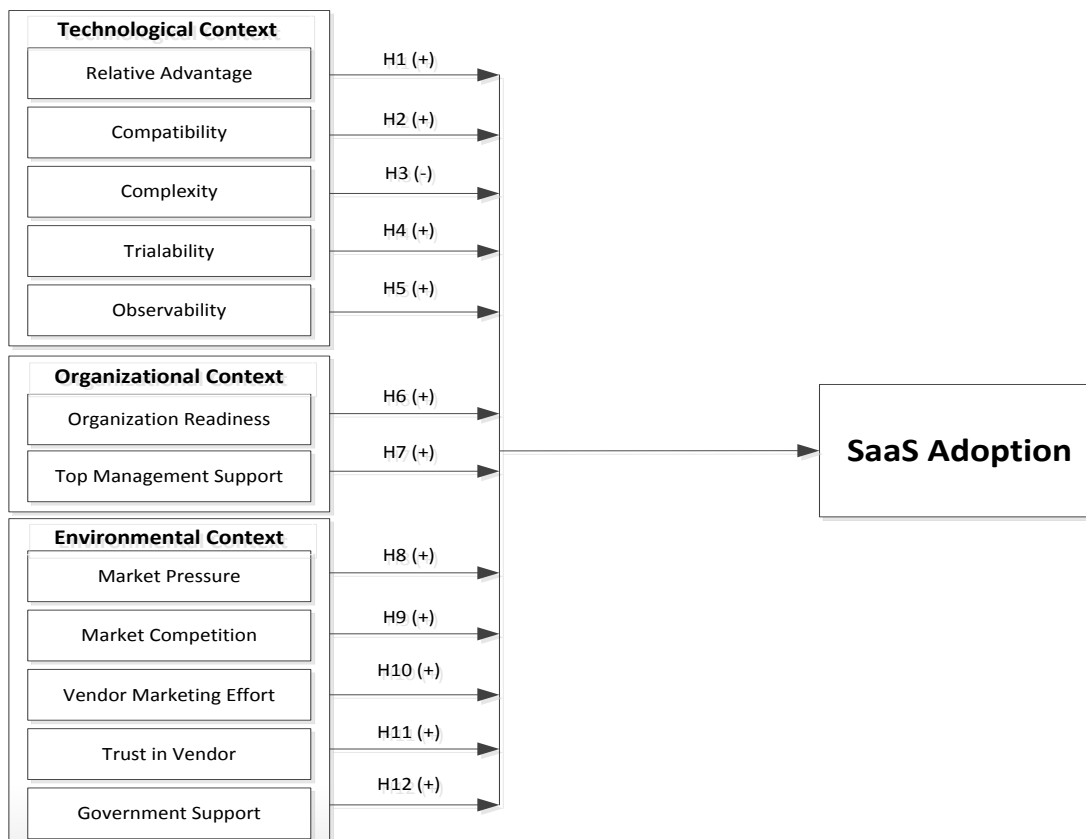
Figure 1.   Research Model

Trialability. A number of studies revealed that trialability is considered as one of the most important components in the process of adopting an innovation (Alshamaila et al., 2013; Ramdani & Kawalek, 2007; Martins et al., 2004; Kendall, 2001). Trialability is the degree to which an innovation may be experimented with on a limited basis (Rogers, 1995). One of the ways to increase the probability of SaaS adoption in Indonesian companies is by allowing them to experience how SaaS works in a free-trial basis. Therefore, we suggested the following hypothesis:

> *H4.   Trialability positively contributes to SaaS adoption in Indonesian companies.*

Observability. Observability is associated with the degree to which the results of an innovation are visible to others (Rogers, 1995). Previous studies have shown that observability was positively related to the adoption decision of IT innovation (Tan et al., 2009; Slyke et al, 2004; Limtongchai & Speece, 2003). When there are visible examples of successful SaaS adopters, potential adopters tend to have considerations to adopt it. Further, Rogers argued that the easier the potential adopters see the results of an innovation, the more likely they will adopt it (1995). To examine this relationship, we hypothesize that:

> *H5.   Observability positively contributes to SaaS adoption in Indonesian companies.*

3.2   Organizational Context

The organizational context refers to the characteristics of an organization such as firm size, top management support, and organization readiness (Alshamaila et al., 2013). A number of studies revealed that organizational readiness and top management support have positive significant effect to the adoption of innovation (i.e., Alshamaila et al., 2013; Al Somali et al., 2012; Huy et al., 2012). Accordingly, we employed these attributes as determinant factors of SaaS adoption in Indonesian companies.

Organizational Readiness. Organizational readiness includes financial resources, human resources, and technology resources, which play a crucial role in the adoption of innovations (Rashid & Al Qirin, 2001). Insufficient funding has been identified as a major factor which hinder IT growth in organizations, mainly in small organizations which have limited capital to spend on IT investment (Kuan & Chau, 2001). Human resources are concerning about the existing of expertise employees who have knowledge and skills on particular innovation in an organization (Pudjianto et al., 2011). Technological resources refer to the installed network technologies and enterprise systems, which provide a platform on which the innovation adopted (Low et al., 2011). When discussing SaaS, it is believed that many organizations delay innovation adoption and tend to wait to adopt it until they have sufficient required resources (Yen et al., 2014). In order to examine this relationship, we suggest the following hypothesis:

> H6. *Organizational readiness positively contributes to SaaS adoption in Indonesian companies.*

Top Management Support. Top management has the power to convince the entire organization about the important of an innovation, and to influence them to participate in its adoption process. Support from the top management can be realized by communicating a company's vision regarding the adoption of an innovation, as well as by creating positive environment and allocating the sufficient resources for the innovation (Alshamaila et al., 2013; Wang et al., 2010; Premkumar & Roberts, 1999). SaaS adoption may involve the integration of resources and the reengineering of business processes. Therefore, support from top management plays an important role for the adoption success (Low et al., 2011). Hence, we propose our next hypothesis:

> H7. *Top management support positively contributes to SaaS adoption in Indonesian companies.*

3.3 Environmental Context

IT innovations do not accommodate only for an internal audience, but also to company's customers, suppliers, and business partners (Premkumar, 2003). Accordingly, it is not unusual that environmental characteristics are increasingly being studied in IT innovation adoption research (Ramdani & Kawalek, 2007). In this study, we investigated five predictors of environmental aspect which have been validated as having significant influence on the adoption of IT innovation. These predictors are: market pressure, market competition, vendor marketing effort, trust in vendor, and government support.

Market Pressure. Market pressure refers to the degree of pressure perceived by a company from its business partners, competitors or government to adopt a specific innovation (Oliveira & Martins, 2010; Al-Qirim, 2007). Evidence from empirical studies found that market pressure is a fundamental factor in the adoption of certain innovation (Al Somali et al., 2012; Huy et al., 2012; Ghobakhloo et al., 2011; Teo et al., 2009). When companies face constant pressure from their competitors or business partners and become increasingly aware of SaaS benefits, they are more likely to adopt SaaS (Lumsden and Gutierrez, 2013). Therefore, we hypothesize that:

> H8. *Market pressure positively contributes to SaaS adoption in Indonesian companies.*

Market Competition. Market competition may drive organizations to initiate and adopt innovations to maintain their competitive edge (Pudjianto et al., 2011), to keep their survival (Ghobakhloo et al., 2011), as well as to compete in their market place (Premkumar & Roberts, 1999). Companies in a more competitive environment would be driven by competitive pressure to leap rapidly from one technology to the next (Zhu et al., 2006). When companies see their competitors receive competitive advantage from SaaS adoption, they tend to follow their competitors to maintain their competitive edge (Lumsden and Gutierrez, 2013; Low et al., 2011). Accordingly, we stated our hypothesis as follow:

> H9. *Market competition positively contributes to SaaS adoption in Indonesian companies.*

Vendor Marketing Effort. Marketing activities which were executed by the vendors has been shown as a significant influencer to the innovation adoption (Alshamaila et al., 2013). Prior researchers have put their effort to draw a connection between vendor marketing efforts and the decision to adopt a particular innovation (Woodside & Biemans, 2005). SaaS adoption in Indonesia is a vendor driver, which means that to increase the level of its adoption, SaaS vendors should be actively involved in introducing it to the Indonesian market (Mangula et al., 2012). In order to prove the existence of this relationship, we propose the following hypothesis:

H10. Vendor marketing effort positively contributes to SaaS adoption in Indonesian companies.

Trust in Vendor. Trust is particularly important when risks, wariness and uncertainties dominate the climate of the business transaction, and it has been established as a critical factor for transacting online business (Gefen, 2002). Trust in a SaaS vendor is crucial because choosing a trustworthy partner is required to form a positive intentions to engage, in spite of the uncertainties and risks perceived by potential adopters (Dyer & Chu, 2003). Trust in a reputable, capable, and trustworthy vendor may reduce uncertainties and increase a positive intention to adopt certain IT innovations (Currie, 2003; Ramiller & Swanson, 2003). Therefore, we hypothesized that:

H11. Trust in vendor positively contributes to SaaS adoption in Indonesian companies.

Government Support. The government, who has the power to encourage the SaaS adoption in Indonesian companies, may give its support in many ways, such as by issuing regulations to protect the customers' data security and confidentiality (Pudjianto et al., 2011), issuing policies to lowering bandwidth cost and hardware/software procurement tax (Zhu et al., 2006), improving national IT infrastructure (Kurnia et al., 2010), providing incentives and financial support (Kraemer et al., 2006) as well as by adopting SaaS within government institutions (Pudjianto et al., 2011). Several findings from previous studies have proved that government support is a critical influencer in innovation adoption (Molla & Licker, 2005). Hence, we propose our hypothesis as follow:

H12. Government support positively contributes to SaaS adoption in Indonesian companies.

4   RESEARCH METHOD

A survey method approach was employed in this study to test and analyze the conceptual model mentioned above. We used a questionnaire for data collection that was distributed to Indonesian companies which might or might not have adopted SaaS applications. The survey was conducted for three months.

4.1   Instrument Development

The research instrument of this study consists of two parts: (1) the demographic characteristics, and (2) the predictors of SaaS adoption. For demographic characteristic, several questions were asked to obtain specific information about the prospective respondents such as job position, job experience on the current position, level of SaaS knowledge, industry type, employees' number, capital, annual sales, and SaaS adoption. A five-point Likert scale ranged from strongly disagree to strongly agree was adopted to measure the SaaS adoption predictors. In this study, 75 survey items for 12 constructs were set out on the questionnaire to identify which factors were dominant in influencing the SaaS adoption in Indonesian companies. The majority of the research items were adopted from existing TOE framework literature which discussed about the Internet-based application adoption in organizations, as well as on SaaS adoption literature, where their validity and reliability have been examined. Slight modifications were made to the questions in order to adapt the SaaS context. Sixteen of the items were developed for this study according to our preliminary interview with SaaS adopters and experts. A close-ended type of question was used on the questionnaire, where each item should be filled in with only one choice.

The questionnaire went through several stages of pretesting before it was administered to the actual samples. First, pretesting was carried out with five Indonesian PhD students of Utrecht University by conducting a focus group discussion (FGD). The main goal of the FGD was to test the clarity of the

questions, which means that they were easy to understand. We also checked whether the original meaning of the questions was preserved during the translation to Indonesian. The backward translation method (Pudjianto et al., 2011) was used for translating the English version of the survey items to Indonesian language. Every effort was made to present the items in a way that could be understood by the Indonesian respondents while keeping the original meaning of the items until both versions converged. As a follow up of this discussion, some items were left out and the instrument was refined. The second stage of the pre-test involved 10 Indonesian IT practitioners that were knowledgeable about SaaS. The survey was distributed to these practitioners and they were asked to give feedback on the question. Some minor changes were made to the instrument based on this feedback. The final stage of pre-test was performed with an expert on innovation study. The expert was asked to evaluate the layout and the user-friendliness of the questionnaire interface. With this input we developed the final version of the questionnaire instrument.

4.2   Data Collection

After the questionnaire was finalized, the survey was distributed as a paper-based version and an online version. A cover letter was attached to explain the purpose of the study, to assure anonymity of respondents and their companies, and to indicate who should complete the questionnaire. The respondents of this study were the IT professionals of the Indonesian companies, that have a basic knowledge of cloud computing. Out of 186 received responses, 39 responses were dropped due to incompleteness of the responses (27) and incompatibility with the respondent's criteria (12). Thus, the amount of valid respondents was 147. Figure 2 presents the characteristics of the respondents.

4.3   Scale Validity and Reliability

In this study, a varimax rotation method with Kaiser normalization was used to ensure that the factor loadings of items and their constructs were greater than 0.5, as recommended by Nunnally (1978). Fifteen (15) items were eliminated since their loadings were below the cut off point and did not use for further analysis. Next, 60 items with eigenvalues of 1 or higher were extracted and proved to explain 86,66 % of the independent variables, which is implying an acceptable and satisfactory degree of construct validity. The adequacy of the sample was examined using the Kaiser-Meyer-Olkin (KMO) analysis. The KMO in this study was 0.65, which means that the matrix of correlation was appropriate for the factor analysis, since it was higher than the threshold value of 0.50 (Kaiser, 1974). The construct reliability was examined using Cronbach's α (alpha) in order to ensure the internal consistency within a construct. The reliability for all contructs were satisfactory and exceed the minimum standard of 0.7, ranging from 0.705 to 0.9972, as prescribed by Nunnally (1978).
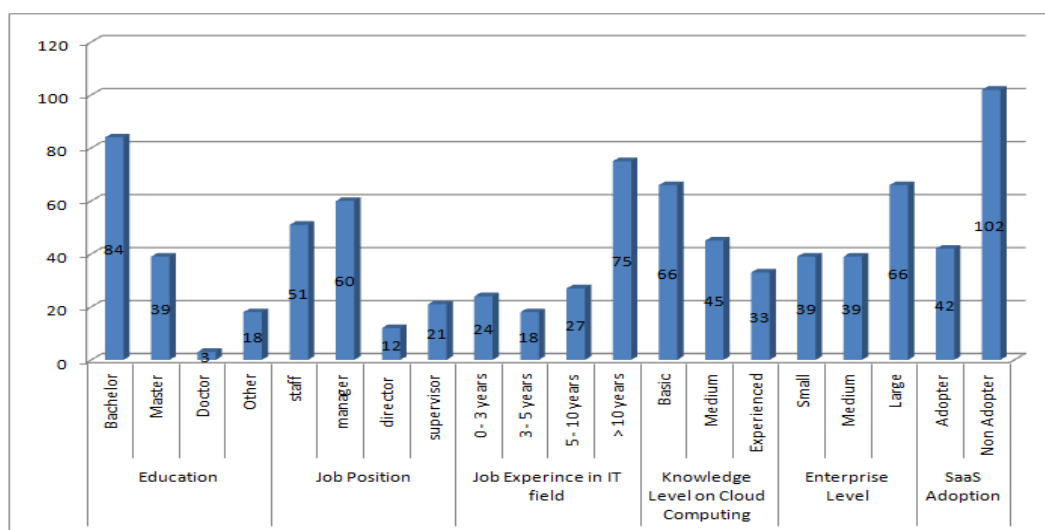

Figure 2.   Characteristics of the Respondents

5   DATA ANALYSIS

This study aims to develop a prediction model for SaaS adoption in Indonesian companies.Since the dependent variable was measured as categorical variable and the independent variables as ordinal variables, we used logistic regressions to test the research model (i.e., Ghobakhloo et al., 2011; Wu et al., 2011; Teo et al., 2009). The participants to the survey were divided into two groups: adopters and non-adopters. Before administering the logistic regression, a linearity test and multicollinearity test were performed to check that each of the predictors was linearly related to the log of the outcome variable as well as to assure that there is no multicollinearity among the independent variables. According to the assumption test of linearity, all twelve interactions have significant values greater than .05 (Field, A., 2009), indicating that the assumption of linearity of the logit has been met for all the predictors. The tolerance level values were greater than 0.1 (ranging between 0.280 to 0.831, and the variance inflation factor (VIF) values were below the threshold of 10 (ranging from 1.203 to 3.576). This indicates that there was no major problem of multicollinearity among the predictors (Hair et al., 1992).
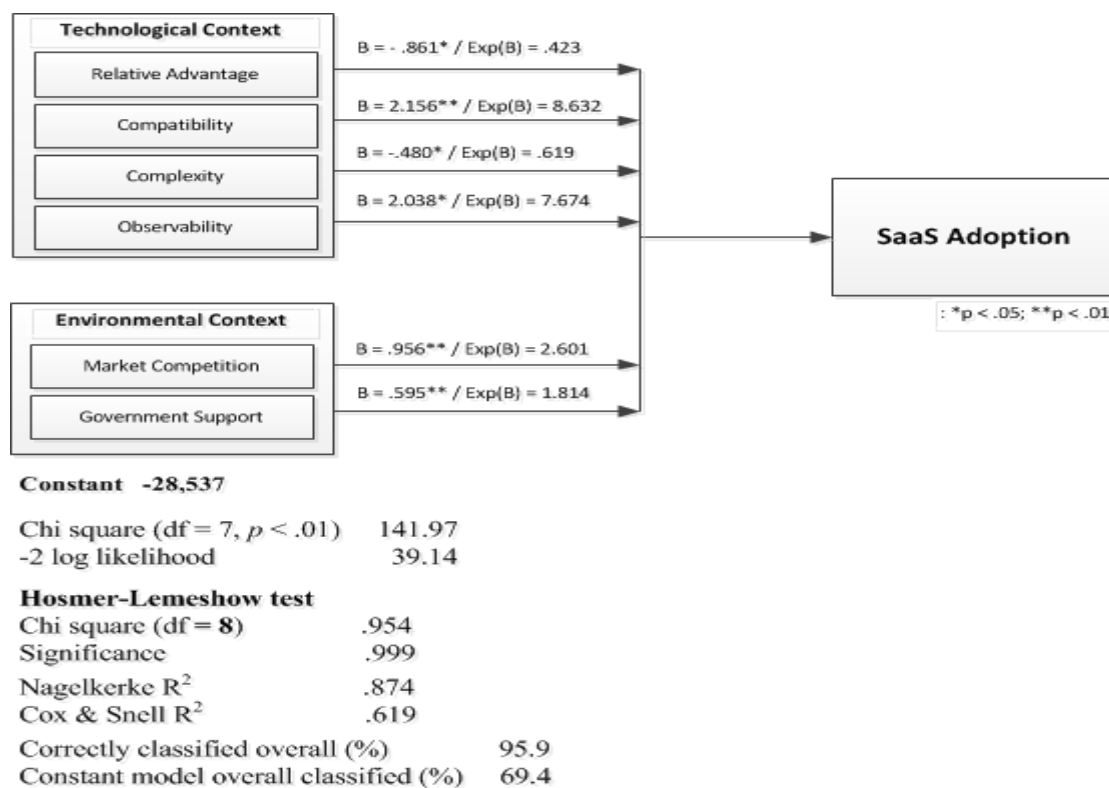

Technological Context

Relative Advantage — B = - .861* / Exp(B) = .423

Compatibility — B = 2.156** / Exp(B) = 8.632

Complexity — B = -.480* / Exp(B) = .619

Observability — B = 2.038* / Exp(B) = 7.674

Environmental Context

Market Competition — B = .956** / Exp(B) = 2.601

Government Support — B = .595** / Exp(B) = 1.814

SaaS Adoption

: *p < .05; **p < .01

Constant -28,537

Chi square (df = 7, $p < .01$)	141.97
-2 log likelihood	39.14

Hosmer-Lemeshow test

Chi square (df = 8)	.954
Significance	.999
Nagelkerke R^2	.874
Cox & Snell R^2	.619
Correctly classified overall (%)	95.9
Constant model overall classified (%)	69.4

Figure 3.   Logistic Regression Results

Next, the logistic regression was carried out to test the hypotheses. In order to be able to estimate how well the research model predicts SaaS adoption in Indonesian companies, we used the likelihood ratio (*Forward: LR* method). The Likelihood Ratio (LR) results were summarized in Figure 2. The overall significance was examined using the Hosmer and Lemeshow goodness-of-fit (Wu et al., 2011; Teo et al., 2009), which was aimed to indicate that the model is a good fitting model, which is represented by the p-value greater than 0.05, or not a good fitting model, which is shown by the *p*-value lower than 0.05 (Lemeshow & Hosmer, 1982). In this study, the Hosmer and Lemeshow goodness-of-fit test (χ^2 = 9.54, df = 8, $p = 0.999$) indicated that there is no significant difference between the survey data and the research model. Therefore, our research model is a good fit. The Cox & Snell R^2 showed that 61.9% of the variation in the dependent variable (DV) was explained by the logistic model, while Nagelkerke R^2 provides an analogy to R^2 in multiple regressions, which stated that 87.4% of the variance was explained by the independent variables.

In this study, 95.9% of overall classifications were corrected, which indicates that there is a considerable improvement on the 69.4% correct classification with the constant model. In other words, we might say that our model indicated a prediction accuracy of 95.9% based on the logistic regression model, which was better than the constant model.

By checking the significant value of all the predictors, we note that six predictors are significantly predicted SaaS adoption in Indonesian companies, which significant values of 0.05 and 0.01. Furthermore, referring to the direction of β coefficient values (negative and positive direction), we conclude that:

- Compatibility, Observability, Market Competition, and Government Support positively contributed to SaaS adoption in Indonesian companies; and

- Complexity and Relative Advantage negatively contributed to SaaS adoption in Indonesian companies.

Therefore, we found evidence to support H2, H3, H5, H9, and H12; while for H1, since the regression coefficient was negative, the hypothesis was rejected.

6   DISCUSSION

This study attempts to establish a fit model for predicting which TOE variables are significant in determining SaaS adoption in Indonesia. In this study, we used the three contexts of the TOE framework (technological, organizational, and environmental context) combined with the five innovation characteristics of DOI theory (relative advantage, compatibility, complexity, trialability, and observability) which are incorporated into the technological context of TOE framework. Our findings indicated that H2, H3, H5, H9, and H12 were accepted, while the others were rejected as seen in Table 1. One of the predictors, relative advantage, showed a significant result, but in a negative direction. Seven predictors, namely relative advantage, trialability, organization readiness, top management support, market pressure, vendor marketing support, and trust on vendor found to be not significant for predicting SaaS adoption in Indonesia.

Hypothesis	Predictors	Accepted	Rejected
H1	Relative Advantage		√
H2	Compatibility	√	
H3	Complexity	√	
H4	Trialability		√
H5	Observability	√	
H6	Organization Readiness		√
H7	Top Management Support		√
H8	Market Pressure		√
H9	Market Competition	√	
H10	Vendor Marketing Effort		√
H11	Trust on Vendor		√
H12	Government Support	√	

Table 1.   Hypotheses Results

6.1   Significant Factors

Technological Context

Prior studies on IT innovation adoption identified relative advantage has a positive contribution for adopting new IT innovations in organizations (i.e., Teo et al., 2009; Tan et al., 2008). Surprisingly, contrary to other findings, we found that this factor had a negative influence on SaaS adoption, meaning that SaaS was perceived by potential adopters as providing less benefit than the current software. The concept of SaaS is relatively new to Indonesian companies, even though this solution has been introduced by the local SaaS vendors to the Indonesian market since few years back (Mangula et al., 2012). Consequently, it creates a lack of awareness on SaaS among them. Moreover,

the fact that most of the respondents in this study (65%) did not have an opportunity to experience how SaaS works on a free-trial basis also cause unawareness on how SaaS was beneficial them.

Compatibility was the contributor for predicting SaaS adoption in Indonesian companies, validating our hypothesis. This finding was confirmed in the previous studies (i.e., Alshamaila et al., 2013; Ghobakhloo et al., 2011; Huy et al., 2012; Wang et al., 2010). In this study, the respondents tended to be more willing to adopt an innovation which perceived compatible with the availability of IT infrastructure, current needs, existing values, and operational activities of the companies. The current needs and IT infrastructure were the most preferred considerations to adopt SaaS, where 66 respondents chose "strongly agree" for these factors.

Our study revealed that complexity negatively predicts SaaS adoption in Indonesian companies, in line our hypothesis and with other studies, such as Huy et al. (2012), Lin & Chen (2012), and Wang et al. (2010). The respondents of this study tend to reject SaaS applications since they perceived that this innovation is difficult to understand and use, needs a certain expertise to be able to use it, and is difficult to be implemented and integrated with existing applications.

In accordance with our hypothesis, observability positively predicts SaaS adoption. This is in line with previous IT innovation studies (i.e., Tan et al., 2009; Slyke et al, 2004; Limtongchai & Speece, 2003). In our study, the respondents tend to adopt SaaS applications if they are aware of the existence of companies that are already use SaaS and are getting benefits from the its implementation.

Environmental Context

Our results also indicated that market competition positively predicted SaaS adoption in Indonesian companies, which confirmed our hypothesis. The results are in line with the findings of prior studies (i.e., Wu et al., 2011; Oliveira & Martins, 2010). Companies in a competitive environment tend to be more reactive and more quickly in responding to new innovations to keep their business alive (To & Ngai, 2006). Our respondents tend to adopt SaaS if they perceive that by adopting SaaS, they are able to compete with their competitors, to survive in a competitive environment, as well as to get the competitive advantage.

Finally, our findings showed that government support positively predicted SaaS adoption in Indonesian companies, which consequently support our last hypothesis (H12). The government's support can be in the form of providing regulations to protect customers' data, to lowering bandwidth cost, lowering taxes concerning hardware and software procurement, improving the national IT infrastructure, and encouraging the use of SaaS adoption in Indonesian companies and government institutions.

6.2   Insignificant Factors

Technological Context

SaaS is perceived as a new innovation to the Indonesian companies; therefore, they may not have the confidence to adopt it into their organizations. Their confidence to adopt SaaS can be increased by providing them the opportunity to try the innovation in a limited period of time. Unfortunately, 49% of the respondents confirmed that the SaaS vendors did not give them the opportunity to experience how SaaS works in supporting their operations. This may be an important reason why the results show that trialability does not significantly influence the adoption SaaS in Indonesia.

Organizational Context

Surprisingly, our study found no significant factor, either it is organization readiness or top management support, in the organizational context. In our descriptive analysis, we found that 65% of the respondents of our study came from large companies, where they have sufficient resources in finance, technology, and human resources to support the implementation of SaaS within their companies. This means that the level of organization readiness in terms of adopting SaaS is high. However, in contrast with their readiness, our study found that organization readiness did not

influence their willingness to adopt SaaS. This may be caused by the lack of support from top management in terms of their lack of SaaS knowledge understanding how SaaS works and its benefits to the companies, where we found that, 64.95% of the respondents confirmed that the level of top management support for SaaS adoption is low.

Environmental Context

In this study, three factors of environmental context are found to have no influence on the adoption of SaaS in Indonesian companies. These are market pressure, vendor marketing effort, and trust in vendor. 84% of the respondents in our study indicated that their companies did not experience any pressure from their business partners or competitors or government to adopt SaaS. Hence, the need to adopt SaaS is not their priority for now. Since SaaS is relatively new to Indonesian companies, a marketing effort from the SaaS vendors to introduce this new term of innovation is a must. 56% of the respondents argued that there is still lack of effort from the local SaaS vendors to promote SaaS for the Indonesian market in terms of providing training or seminar about SaaS, as well as of assisting the companies when they have problems on SaaS. Lack of trust is frequently cited as one of the barriers for adopting an Internet-based application (Karpinski, 2000; Kim & Benbasat, 2003). As an Internet-based application, SaaS adoption creates uncertainty and wariness among Indonesian companies. The open nature of an Internet-based application brings major issues regarding data security and confidentiality on SaaS adoption. Moreover, the law enforcement in Indonesia remains on a low level (Pudjianto et al., 2011). 62% of the respondents expressed their lack of trust in the SaaS vendors in Indonesia. This issue might be caused by their lack of their awareness on the existence of Indonesian SaaS vendors as well as the lack of effort of the SaaS vendors to introduce SaaS and their services.

7 CONCLUSIONS, IMPLICATIONS, AND FURTHER RESEARCH

SaaS remains a relatively new IT innovation for Indonesian companies, even though this innovation has been around for almost a decade. In this study, we developed a model for determining which factors are significant in determining and hindering SaaS adoption in Indonesia. This study was theoretically grounded in the TOE framework. Unexpectedly, we found that only two contexts of this framework (technological and environmental) had a contribution for predicting SaaS adoption in Indonesian companies, while the organizational context, including organization readiness and top management support, did not contribute to the adoption of SaaS. We found four positive determinants including compatibility, observability, market competition, and government support, as well as two negative determinants namely relative advantage and complexity that contributed to SaaS adoption in Indonesian companies. In addition, regarding the use of Rogers' characteristics of innovations which incorporated in the technological context of TOE framework, this study indicated that four out of five characteristics have significant contribution to predict the adoption of SaaS in Indonesian companies. This is in line with the results of Lin & Chen (2012).

Research on SaaS adoption in Indonesia is scarce, especially considered from the end-users perspective. Therefore, the findings of this study have several important implications for researchers of SaaS and innovation adoption, Indonesian policy makers and SaaS vendors. For policy makers, this study can be a reference to create specific programs for encouraging SaaS adoption in Indonesian companies, which is part of the goverment support. For example, a reliable Internet connection is required to facilitate data delivery through the SaaS application, therefore, a good national IT infrastructure is essential. For SaaS providers, the research model in this study may provide better understanding of why companies choose to adopt or not to adopt SaaS. Thus they can formulate better strategies to increase the intention of companies in Indonesia to adopt SaaS. This recommendation is part of the vendor marketing effort. One important way to promote SaaS adoption is by providing evidence of the existing companies that successfully adopted SaaS and received major benefits from its adoption. This will help the non-adopting companies to understand the concept and realise the potential benefits of SaaS. Our study confirmed this by showing that the more visible existing SaaS adopters are to the companies, the more likely they will adopt SaaS.

Our study adopted a survey-based research method which has few drawbacks compared to the case study method. Firstly, since a questionnaire is typically self-administered (either paper-based or online-based survey), if interesting phenomena start to appear, it is usually not possible to ask follow-up questions, or go back and change the original survey instrument to ask more detailed questions. On the other side, this type of survey has some advantages such as its capability to collect data from a large number of respondents and to analyze multiple variables. On the other side, survey-based research also has some advantages such as capable of collecting data from a large number of respondents and can be used to analyze multiple variables. A surprising result was revealed from this study which associated with the nonexistence of the two main constructs of organizational context (organization readiness and top management support) for predicting SaaS adoption in Indonesia. The result was inconsistent with most of innovation adoption studies using TOE framework. Therefore, in order to have greater detail and better explanation about this interesting phenomena and to validate the findings of this study, a case study research can be performed for future research. Secondly, our study did not discuss the role of companies size on the adoption of SaaS in Indonesia, while the results of this study indicated that 64.7% of the respondents were the large-sized enterprises. Thus, further research could examine the relationship between companies size and the decision to adopt or reject SaaS.

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