SMALL AND MEDIUM ENTREPRENEURS' INTENTION TO USE CLOUD COMPUTING: REFERENCE TO EASTERN PROVINCE OF SRI LANKA

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ABSTRACT

Cloud computing has become one of the keywords in the industry today. Although being not new concept in computing because of the proliferating growth of internet with amazing bandwidth, arrival of mobile devices and requirements of end-users. This paper focuses on the small medium entrepreneurs' intension to use cloud computing services, particularly the Eastern province of Sri Lanka. This paper presents seven factors influencing entrepreneurs' intension. Instruments were developed based on previously studies and study used quantitative method. Data were collected conveniently. Instrument was tested for reliability,regression analysis was performed to see the strength independent variables on the dependent and it was found technological as well as organizational characteristics significantly influence small medium entrepreneurs' intension to use cloud computing services, which is consistent with many previous studies.

Key words: *Cloud computing, intension to use, small medium entrepreneurs, technology, organization.*

Introduction

Because of severe market competition and a dramatically changing business environment, firms have still prompted to adopt various high-tech information technologies (IT) to improve their business operations (Pan and Jang, 2008; Sultan, 2010). Recently, the term Cloud Computing has been critical in the world of IT. The use of internet-based technologies to conduct business is recognized as an important area for IT innovation and investment (Armbrust et al., 2010; Goscinski and Brock, 2010). Cloud computing has spread out through the main areas related to information systems (IS) and technologies, such as operating systems, application software, and technological solutions for firms (Armbrust et al., 2010). Cloud computing is a kind of computing application service that is like e-mail, office software, and enterprise resource planning (ERP) and uses ubiquitous resources that can be shared by the business employee or trading partners. Thus, a user on the internet can communicate with many servers at the same time, and these servers exchange information among themselves (Hayes, 2008). Moreover, telecommunication and network technology have been progressing fast; they contain 3G, 4G, etc. so the high speed infrastructures are integrated strongly. Cloud computing services can provide the user seamlessly, the convenience, and the quality stable technological support that can develop the enormous potential demand (Buyya et al., 2009; Pyke, 2009). Thus, cloud computing provides the opportunity of flexibility and adaptability to attract the market on demand.

Literature Review

Cloud Computing

McAfee (2011) observe that cloud computing comprises three services: Software-as-a-Service (SaaS): Instead of installing software on the client's machine and updating it with regular patches, frequent version upgrades etc., applications like Word processing, CRM (Customer Relationship Management), ERP (Enterprise Resource Planning) are made available (hosted) over the internet for the consumption of the end-user. It can achieve economies of scale. This is the biggest and most mature cloud model. Commercial vendors are Yahoo Mail, Gmail, Hotmail, TurboTax Online, Facebook, Twitter, Microsoft Office Live, Google Apps, Salesforce.com, Cisco WebEx web conferencing, antivirus, Success Factors (HRM tool) etc., Platform-as-a-Service (PaaS): Instead of buying the software licenses for platforms like operating systems, databases and middleware, these platforms and the software development kits (SDKs) and tools (like Java, .NET, Python, Ruby on Rails) are made available over the Internet. Commercial vendors include Microsoft Azure Services, Amazon Web Services (AWS), Sales-force's Force.com, Google App Engine platform, IBM Cloud burst, Amazon's relational database services, Rackspace cloud sites, Infrastructure-as-a-Service (IaaS): This refers to the tangible physical devices (raw computing) like virtual computers, servers, storage devices, network transfer, which are physically located in data centers but they can be accessed and used over the internet using the login authentication systems and passwords from any dumb terminal or device. Commercial vendors include Amazon EC2 (Elastic Compute Cloud), Elastic Block Storage (EBS) and Simple Storage Service (S3), Rackspace cloud servers, etc.

There are four different cloud deployment models within organizations namely (Marston et al., 2011; Rath, 2012): Public cloud: It is available from a third party service provider via Internet and is very cost effective for universities to deploy IT solutions. For example, Google Apps.

Private cloud: It is managed within an organization and is suitable for large enterprises. For example, the US government cloud product is in a segregated environment, both physically and logically and is being handled by a third party provider, Google. Private clouds provide the advantages of public clouds but still incur capital expenditures. Community cloud: It is used and controlled by a group of enterprises, which have shared interests. For example, the US federal government using community cloud for USA.gov, cars.gov, Apps.gov. Hybrid cloud: It is a combination of public and private cloud.

TOE Framework

Tornatzky and Fleischer (1990) summarized previous studies on innovative information technology adoption and proposed the Technology-Organization-Environment (TOE) framework to understand the critical factors affecting the introduction of new information technology. Their framework contains three major elements that affect the process of adopting innovation technology and it includes the organization dimension, technology dimension and environment dimension (Tornatzky & Fleischer, 1990).

This study focuses on Technology and Organization factors and proposes a two dimensional model (Fig. 1), which incorporates the variables of technology and organization factors in understanding the decision to adopt cloud computing by small medium entrepreneurs in Eastern province of Sri Lanka.

Research Model and Hypotheses

The research model of this study incorporates technologicaland organizational contexts as important determinants of cloud computing adoption.

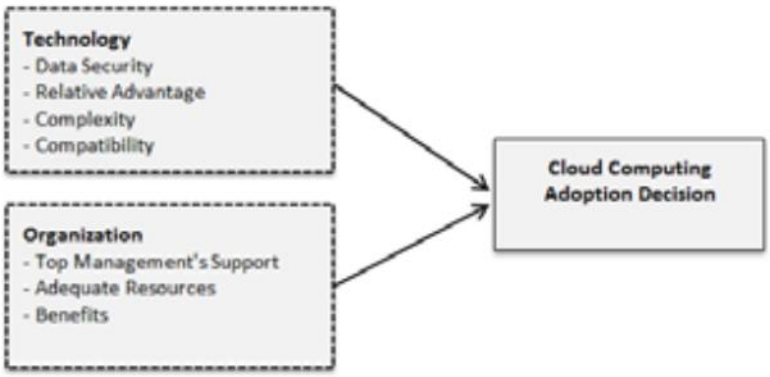

Fig.: Research Model

Technology dimension

The technology dimension entails the internal and external influences of adopting specific information technology in the organization. Due to the nature of cloud computing technology, ***data security*** and privacy are the major concerns for adoption (Kuo, 2011). As a result, establishing a secure environment for cloud based enterprise resource planning system data integration and sharing is indeed critical (Chen, Lu, & Jan, 2012). For this reason, data security is included as one of the critical key variables in the technology dimension.

Rogers (1983) defined ***relative advantage*** as the degree to which a technological factor is perceived as providing greater benefit for firms. It is reasonable that firms take into consideration the advantages that stem from adopting innovations (To and Ngai, 2006). Cloud computing services, which allow operations to be generalized and mobilized through internet transactions, can substitute for or complement ERP software. The study of Premkumar and Roberts (1999) indicated that relative advantages will affect businesses and push them to adopt new information technologies.

Firms may not have confidence in a cloud computing system because it is relatively new to them (Buyya et al., 2009). It may take users a long time to understand and implement the new system. 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). ***Compatibility*** refers to the degree to which innovation fits with the potential adopter's existing values, previous practices and current needs (Rogers, 1983). Compatibility has been considered an essential factor for innovation adoption (Cooper and Zmud, 1990; Wang et al., 2010). When technology is recognized as compatible with work application systems, firms are usually likely to consider the adoption of new technology. When technology is viewed as significantly incompatible, major adjustments in processes that involve considerable learning are required.

Previous studies have also indicated that IS complexity (Changet al., 2007) and compatibility will affect IT adoption decision positively (Lin et al., 2012; Liu, 2011) for those in the higher education industry. Therefore, perceived system complexity will be a key criterion when making an adoption decision. Furthermore, higher education ERP modules that handle students' enrollment, examination and researches by staff, etc. are rather unique by nature. How to migrate these data with the cloud computing platform will also be a critical factor these organizations need to consider. Consequently, the level of system compatibility is another key factor in the technical dimension. If cloud computing technology can be compatible with the existing systems or applications of the university, then it will be more helpful and also more feasible for the adoption of cloud computing technology.

Because of the varied and extensive nature of the costs, organizations can find the expenses associated with this type of project to be very sizable. For this reason, costs will also be a critical factor for the adoption decision.

Based on the above discussions, this dimension is composed of four variables. These variables are Data Security, Relative Advantage, Complexity and Compatibility.

From the aforementioned theory, the following hypothesis has been developed:

H1: *There will be a positively significant relationship between Technology Factors and the Adoption Decision of cloud computing.*

Organization dimension

Organizational factors will affect the intention to adopt new information systems technology (Chang, Hwang, Yen, &Lian, 2006; Hsiao et al., 2009). In this study, the organizational dimension represents different organizational conditions including variables such as Top Management's Support, Adequate Resources, and Benefits for adoption.

Top management's support refers to whether or not the executives understand the nature and functions of cloud computing technology and therefore fully support the development of it. The study of Chang *et al.* (2006) found that top management's support will affect new IS adoption. Top management support is critical for creating a supportive climate and for providing adequate resources for the adoption of new technologies (Lin and Lee, 2005; Wang *et al.*, 2010). As the complexity and sophistication of technologies increase, top management can provide a vision and commitment to create a positive environment for innovation (Lee and Kim, 2007; Pyke, 2009).

If a given organization has a sufficient budget, adequate human resource support, ample time, and good top management's involvement, then the adopting of cloud computing technology will be met in a positive manner. To this end, ***adequate resources*** are also critical to the success of adoption (Chang *et al.*, 2007).

Finally, potential ***benefits*** such as improving anorganization's image, gaining strategic advantage over others, improving their service quality, and enhancing the efficiency of internal operations will also be critical. The study of Chang et al. (2006) found that the benefits of IS will lead to a positive adoption. The measurements used for this dimension were adapted from the studies of Premkumar and Roberts (1999), Chang et al. (2007), and Kuan and Chau (2001) respectively.

Based on the above discussions, this dimension is composed of three variables. These variables are Top Management's Support, Adequate Resource and Benefits.

From the aforementioned theory, the following hypotheses have been developed:

H2: *There will be a positively significant relationship between Organizational Factors and the adoption of cloud computing.*

Research Method

The research is a quantitative study based on questionnaire survey. Quantitative method enables the researcher to test the relationships between the variables identified in the model and thereby let him provide evidence to support or disprove the hypotheses (Carter and Belanger, 2005). The population of this study included all small and medium sized organizations in the Eastern province of Sri Lanka. As the Sampling frame was not available the sampling method became non-probabilistic convenient sampling. According to Hair *et al.* (1998) as cited by Rehman*et al.* (2012), "*each independent variable is expected to have ten data records"*; since this study had seven independent variables, 70 respondents would have sufficed. According to Sekaran and Bougie (2010), "*sample sizes larger than 30 and less than 500 are appropriate for*

most research". Therefore, the size of the sample was decided to be at least 250 small and medium entrepreneurs. Although there are many data collection methods available, because of constraints in terms of time, costs and human resources, the questionnaires were administered personally using drop-off and pick-up approach for printed questionnaires and published on 'web-forms'.

The data collected were examined for outliers, coded and scored appropriately. The initial analysis included an examination of descriptive statistics of demographic variables. Reliability test was conducted to see the consistency of data and Principal Component Analysis was also performed. The resultant variables of the factor analysis were used to see the strength of relationship as well as strength of explaining ability of the variables. These regression tests involved calculating and comparing to gain insight into the nature of the relationship between independent variables and dependent variable. MS Excel 2010 and SPSS 20 were used for analysis.

Data Analysis

Scale Reliability and Factor Analysis

The constructs were tested for reliability by calculating Crobach's Alpha. A total of 30 items were developed to capture the eight constructs under investigation. In order to improve the reliability, two items were removed, one in Top Management's Support and another in Benefits, thereby making the Alpha value well above 0.7 (Hair et al., 1998). Table 1 shows the variables, Alpha values and number of items for each variable.

Variable	Cronbach's Alpha	No. Items
Data security	0.728	2
Relative advantage	0.872	3
Complexity	0.899	5
Compatibility	0.818	3
Top management's support	0.923	3
Adequate resource	0.896	5
Benefits	0.659	4
Intension to Use	0.746	3

Results and Discussion

A regression analysis was undertaken based on the research model which included independent variables and dependent variable. As there were two categories of variables namely Technology and Organization, the regression analysis was run for each category separately. The analysis was facilitated by SPSS software, which investigated the relationship of predictors to outcome variable.

The first analysis was run between Technology variables, namely Data Security, Relative Advantage, Complexity and Compatibility, and Intension to Use variable. The resultant ANOVA (Table 2), showing Significance of .001 or one chance in 1000 of incorrect rejection of null hypotheses, confirms that the data between Technology-predictor variables and Intension outcome variable are strongly correlated and there is a good model.

Table 2: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	191.513	4	47.878	222.436	.000[b]
	Residual	54.242	252	.215		
	Total	245.755	256			

a. *Dependent Variable: IntensionToUse, b. Predictors: (Constant), Dat_Security, Re_Advantage, Compatibility, Complexity*

The coefficient of determination of the contribution of Technology variables to Intention to Use, the R2, value from Table 3 which is 0.779 (Adjusted R2 .776) indicates a shared variation of about 78% between Technology variables data and Intention to Use data. That is, approximately 78% of the variances in Intention to Use can be accounted for by knowledge of Technology variables alone.

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	.883[a]	.779	.776	.536	.000

a. *Predictors: (Constant), Dat_Security, Re_Advantage, Compatibility, Complexity*

According to Table 4, the Beta values of Data Security (.617), Relative Advantage (.788), Complexity (.756) and Compatibility (.678) show positive correlations. While the constant is insignificant, all predictor variables show significance of .000, indicating a probability of less than one in 1000 of Type-I error; significantly positive relationships between predictor variables and outcome variable. With a unit increase in Data Security factor, Intension factor will increase by .604 units. The Intension factor will increase by .773 units when there is one unit increase in Relative Advantage factor. A unit increase in Complexity factor and Compatibility factor will cause .740 unit and .665 unit increase in Intension factor respectively.

Table 4

Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	.059	.034		.088
	Dat_Security	.604	.048	. 617	.000
	Re_Advantage	.773	.038	. 788	.000
	Complexity	-.934	.040	-.954	.000
	Compatibility	.665	.045	.678	.000

a. Dependent Variable: Intension to Use

The second analysis was run between Organization variables, namely Top management's support, Adequate resource and Benefits, and Intension to Use variable. The resultant ANOVA (Table 5), showing Significance of .001 or one chance in 1000 of incorrect rejection of null hypotheses, confirms that the data between Organization-predictor variables and Intension outcome variable are strongly correlated and there is a good model.

Table 5: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	183.083	3	61.028	246.361	.000[b]
	Residual	62.672	253	.248		
	Total	245.755	256			

[a.] *Dependent Variable: IntensionToUse, b. Predictors: (Constant), Top_Man_Support, Benefits, Resources*

The coefficient of determination of the contribution of Organization variables to Intention to Use, the R2, value from Table 5 which is 0.745 (Adjusted R2 .742) indicates a shared variation of about 75% between Organization variables data and Intention to Use data. That is, approximately 75% of the variances in Intention to Use can be accounted for by knowledge of Technology variables alone.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	. 863[a]	. 745	. 742	. 498	.000

[a.] *Predictors: (Constant), Top_Man_Support, Benefits, Resources*

According to Table 6, the Beta values of Top Management's Support (.799), Adequate Resources (.744) and Benefits (.818) show positive correlations. While the constant is insignificant, all predictor variables show significance of .000, indicating a probability of less than one in 1000 of Type-I error; significantly positive relationships between predictor variables and outcome variable. With a unit increase in Top Management's Support factor, Intension factor will increase by .783 units. The Intension factor will increase by .729 units when there is one unit increase in Adequate Resources factor. A unit increase in Benefits factor will cause .801 units increase in Intension factor.

Table 7

Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	-.014	.037		.708
	Top_Man_Support	.783	.037	.799	.000
	Resources	.729	.041	.744	.000
	Benefits	.801	.035	.818	.000

a. Dependent Variable: Intension to Use

The nature of cloud computing is very much in close relationship to the core of the business processes. The purpose of this study is to enhance the understanding of intension to use cloud computing by small medium entrepreneurs in the Eastern province of Sri Lanka. We found that there are seven factors that drive the intension to use cloud computing. They are Data Security, Relative Advantage, Compatibility, Complexity, Top Management Support, Adequate Resources and Benefits.

Data Security was seed to have significant and positive influence on firms' intension to use cloud computing services; the higher the security the more intended the entrepreneurs. Relative advantage was observed to have significantly positive influence on the intension to use cloud computing by small medium entrepreneurs in the Eastern province. This finding is consistent with previous studies by Tan et al. (2008) and Wang et al. (2010). The relative advantage of cloud computing services usage would improve the speed of organizational communication, coordinating efficiency among firms, communication with clients as well as access to market information, etc. (Armbrust et. al., 2010). Expectedly, complexity and compatibility were found to be significant discriminators which mean that small medium entrepreneurs think that cloud computing usage has technological complexity and compatibility. If the complexity in usage and charging looks complex then entrepreneurs would not intend to go for such systems and also if the new system would not go hand in hand with existing legacy system then they would not risk such new systems, and this find is consistent with earlier studies by Wang et. al., (2010) and Oliveria and Martins (2010).

Organizational characteristics would play a major role in decision making process (Cho, 2006) of entrepreneurs. This study have found that top management's support, adequate resources and benefits to significant factors in determining small medium entrepreneurs intension to use cloud computing services. Benefits offer motivation for people to use an innovating technology if they expect relative advantages from a new system to enhance work efficiency Wang et al. (2010). It is clear that if top management's support and adequate resources available and potential benefits are understood, then intension to use an innovative technology would increase.

Conclusions

In order to promote the intension to use and adopt cloud computing it is vital to delineate the factors that influence this intension. Like the pros of this innovative technology there are cons as well, which hinders or defames its usefulness. One such feature is the downtime which is different for provider to provider. The complexity and compatibility of implementing cloud computing could be another barrier to the intension to use such technology. Therefore, it is important to understand the impact of factors influencing the intension to use cloud computing services in small medium industries. Small medium firms that would like to use cloud computing services could start with incremental implantation by means of slowly adding the number of process by establishing more internet infrastructures. These firms can start implement cloud services into businesses by beginning with accounting information systems and customer relationship management systems, etc. and these systems are of high benefits and make the firms to compete with rivals competently.

This study presents key finding that influence the small medium entrepreneurs intension to use cloud computing services. The findings reveal that whether small medium entrepreneurs intend to use cloud computing services depend on firm's technological factors; data security, relative advantage, complexity and compatibility as well as organizational factors; top management's support, adequate resources and benefits.

Further researches can include environmental factors and the scope can be extended to include whole country.

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