

An Explorative Model for B2B Cloud Service Adoption in Korea - Focusing on IaaS Adoption

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Abstract

As the global recession has made it more difficult for companies to invest in IT, cloud computing have emerged as a new paradigm in the business IT as green IT. Among several types of cloud services, the Infrastructure as a Service (IaaS) solution is used by many companies in Korea. The Technology Acceptance Model(TAM) and extended model have been popularly utilized for examining how users come to accept a new information technology, but have not yet been applied to IaaS adoption of B2B cloud services. This paper attempts to explore companies' adoption behaviors toward the B2B cloud services that were recently deployed in the Korean market. Especially, we focus on IaaS among B2B cloud services provided in Korea. In order to achieve the goal, we identified key influencing factors that affect the companies' adoption behaviors, based on an extension of the TAM. An explorative model is proposed and a number of hypotheses are tested and analyzed. The study results can not only help company users gain insights into IaaS adoption, but also help IaaS providers improve both new cloud service development and marketing strategy

Keywords: *B2B Cloud Service, IaaS, TAM, Adoption Behavior*

1. Introduction

The emergence of cloud computing represents a fundamental change of information and communication technology (ICT) services as delivering on-demand resources such as infrastructure, platform and software to customers similar to utilities. There are three main cloud services provided according to the demands of ICT customers [1-3]. Firstly, Software as a Service (SaaS) provides access to complete applications as a service, such as ERP (Enterprise Resources Planning), SCM (Supply Chain Management), CRM (Customer Relationship Management) and groupware [4]. Secondly, Platform as a Service (PaaS) provides a platform to develop other applications, such as force.com, Facebook F8 and Google App Engine (GAE) [5]. Finally, Infrastructure as a Service (IaaS) provides an environment for deploying, running and managing virtual machines and storage such as Amazon S3&EC2, Joyent, GoGrid, AT&T, KT ucloud, and SKT Tcloud [1, 2].

Cloud services continue to grow rapidly, with increasing functionality and more users around the globe as well as Korea [6]. As a result of this growth, the global and Korean major cloud service providers launched commercial B2B and B2C cloud services typed as public and private in the market as shown in Figure 1. Consumers want more user-friendly services and want to access their private files stored in cloud service deposits at anytime and from anywhere. Cloud services are expected to change the personal lifestyle and to give an opportunity for providers to make new business models. In addition, Enterprises is also to deliver a network of virtual services so that users can access them from anywhere in the world without making high capital investment to procure ICT infrastructure, skilled ICT experts and

system managers. Therefore, they do not invest infrastructure to deploy their service or do not spend labor cost to operate their services [7-9].

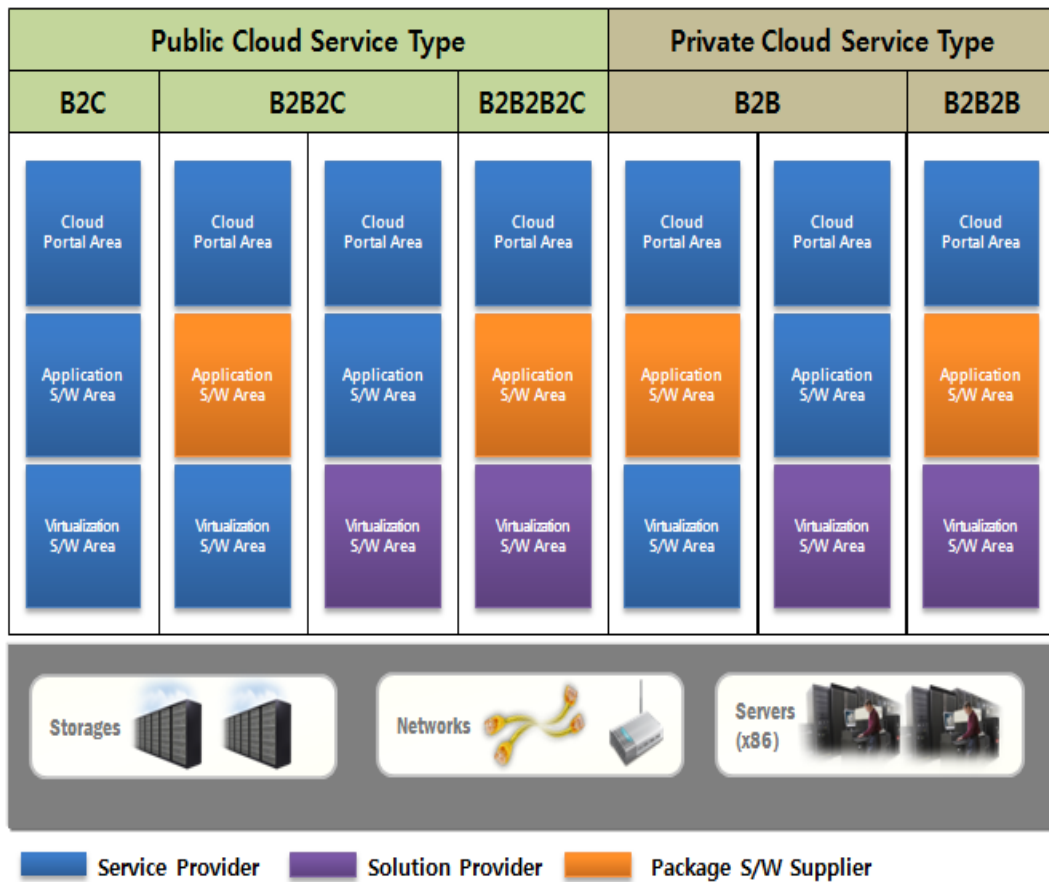


Figure 1. Business Commerce Types of Cloud Services

The technology acceptance model (TAM) proposed by Davis [10] is a widely applied to explain user behavior and new information technology and system usage. But TAM did not include and consider some important factors such as individual's attitude and social factors. Therefore some modified TAMs were proposed to overcome these problems [11-13]. In this study, we adopt the extended TAM including some important factors to analyze and explain the user behavior of cloud service.

The objective of this study is to analyze adoption behavior of B2B cloud Service in Korea. Among several types of cloud services as mentioned before, we focus on Infrastructure as a Service (IaaS) used by many companies in Korea. This study attempts to explore companies' adoption behaviors toward the B2B IaaS that were recently deployed in the Korean market. In order to achieve the goal, we identified key influencing factors that affect the companies' adoption behaviors, based on an extension of the TAM. An explorative model is proposed and a number of hypotheses are tested and analyzed.

2. Research Background

2.1. Cloud Computing and Cloud Service

Cloud computing is the use of computing resources such as hardware, platform and software that are delivered as a service over a network. End users access cloud-based applications through a web browser or mobile application while the business software and user's data are stored on servers at a remote location. Cloud computing relies on sharing of resources to achieve coherence and economies of scale similar to a utility over a network [14].

Cloud computing is commonly classified into public, private and hybrid clouds [15-18]. Public cloud includes cloud services offered in public domains. This method is for companies wishing to save costs and time without obligations of deployment and maintenance. For enterprises without cloud computing deployment, this is the quickest way to make use of cloud computing. Drawbacks range from concerns for data security in public domains including data loss and conflicts concerning legal and ethical issues. Private cloud includes cloud services deployed within the enterprise, thus data and accessibility are only for internal users of a company. This method is suitable for companies focusing on privacy and data security. The implementation of private cloud services can be complicated, time-consuming or costly works. Hybrid cloud is to use part public cloud and part private cloud. This method is suitable for enterprises hoping to reduce costs, whilst maintaining privacy and data security. It is difficult to integrate the different architectures between public and private clouds

As mentioned before, cloud computing providers offer their services according to several fundamental models and there are three general types of services such as IaaS, PaaS and SaaS. Infrastructure as a Service (IaaS) provides computers such as physical or virtual machines and other resources. IaaS providers supply these resources on-demand from their large pools installed in data centers. Platform as a Service (PaaS) provides computational resources via a platform upon which applications and services can be developed and hosted. PaaS providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without buying and managing the underlying hardware and software layers. Software as a Service (SaaS) provides implementations of specific business functions and business processes that are provided with cloud capabilities. Therefore, they provide applications and/or services using a cloud infrastructure or platform.

2.2. The Technology Acceptance Model (TAM)

The technology acceptance model (TAM) specifies the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual usage behavior as shown in Figure 2. Overall, the TAM provides an informative representation of the mechanisms by which design choices influence user acceptance, and should therefore be helpful in applied contexts for forecasting and evaluating user acceptance of information technology [19]. The TAM uses the Theory of Reasoned Action as the theoretical basis, for specifying the causal linkages between perceived usefulness (PU), perceived ease of use (PEOU), users' beliefs and acceptance, and the actual usage of the particular technology [20-22].

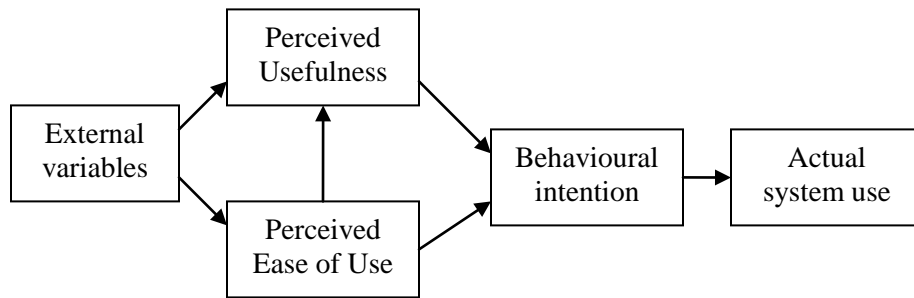


Figure 2. Technology Acceptance Model

2.2.1. Perceived Security: Perceived security (PSE) may be defined as the subjective probability with which consumers believe that their information will not be viewed, stored, or manipulated during data transmission and storage by inappropriate/unauthorized parties, in a manner consistent with their expectations [19, 22]. The one of critical issues of cloud computing is security and PSE is very important factor to accept the cloud service. Therefore the PSE is adopted as a key influencing factor of the companies' adoption behavioral intention.

2.2.2. Perceived scalability: Perceived scalability (PSC) may be defined as the ability of a system, network, or process to handle a growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth [23]. PSC can refer to the capability of a system to increase total throughput under an increased load when resources are added. The one of critical characteristics of the cloud service is scalability and PSC is very important factor to use the cloud service. Therefore PSC is adopted as a key influencing factor of the companies' adoption behavioral intention.

3. Research Model and Hypotheses

3.1. Research Hypotheses

The factors influencing companies' adoption of cloud services can vary, depending on the IT, the target companies, and the context. The constructs PU and PEOU of B2B cloud service were adapted from TAM. These constructs have also been maintained for studying the adoption of cloud services where results fairly well comply with the findings from TAM studies.

TAM posits that a user's acceptance of the information service is determined by that user's behavioural intention to use the service, while PU and PEOU can predict the usage intention, and PEOU is hypothesized as a predictor of perceived usefulness. Both PU and PEOU are beliefs. In addition, TAM states that PEOU will have a direct effect on PU.

Therefore, we propose the following three hypotheses from TAM:

H1: PU positively affects behavioural intention to use IaaS.

H2: PEOU positively affects behavioural intention to use IaaS.

H3: PEOU positively affects PU.

Perceived security (PS) is most important element to use cloud services. Security refers to the protection of information or systems from unsanctioned intrusions or outflows [24]. Fear of the lack of security is one of the factors that have been identified in most studies as affecting the growth and development of technology including cloud service adoption. Therefore PU and PEOU may not fully explain behaviour attitude to use cloud services. Considering the context of cloud services, we expand the TAM by adding PS to the model to explain company acceptance of a cloud service, especially IaaS.

We propose the following hypothesis:

H4: PS positively affects behavioural intention to use IaaS.

Perceived security (PS) is most important element to use cloud services. Security refers to the protection of information or systems from unsanctioned intrusions or outflows [24]. Fear of the lack of security is one of the factors that have been identified in most studies as affecting the growth and development of technology including cloud service adoption. Therefore PU and PEOU may not fully explain behaviour attitude to use cloud services. Considering the context of cloud services, we expand the TAM by adding PS to the model to explain company acceptance of a cloud service, especially IaaS.

We propose the following hypothesis:

H4: PS positively affects behavioural intention to use IaaS.

Findings from the characteristics of cloud services have confirmed the importance of appropriate levels of perceived scalability (PSC) in cloud services adoption decisions. As described above, PSC is the ability of a cloud service, network, or process to handle a growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth. In addition, PSC influences PU because PSC is the main factor to use cloud services. Consequently, our research assumes that company users with PSC are more likely to adopt IaaS. We consider the context of cloud services, so we also extend the TAM by adding PSC to the model to explain company acceptance of a cloud service, especially IaaS.

Therefore, we formulate the two more hypotheses as follows:

H5: PSC positively affects behavioural intention to use IaaS.

H6: PSC positively affects PU.

3.2. Research Model

Based on the previous studies and the above arguments, we propose the research model integrated TAM with additional factors to examine adoption behaviour of the B2B cloud service as shown in Figure 3. Figure 3 represents the theoretically proposed model to be tested and analyzed. The arrows linking constructs specify hypothesized causal relationships in the direction of arrows. The arrows between constructs and indicators symbolize measurement validity. The constructs of PU, PEOU and behavioural intention to use were retained according to TAM. PS and PSC were introduced and identified by considering the characteristics and importance of cloud services usage.

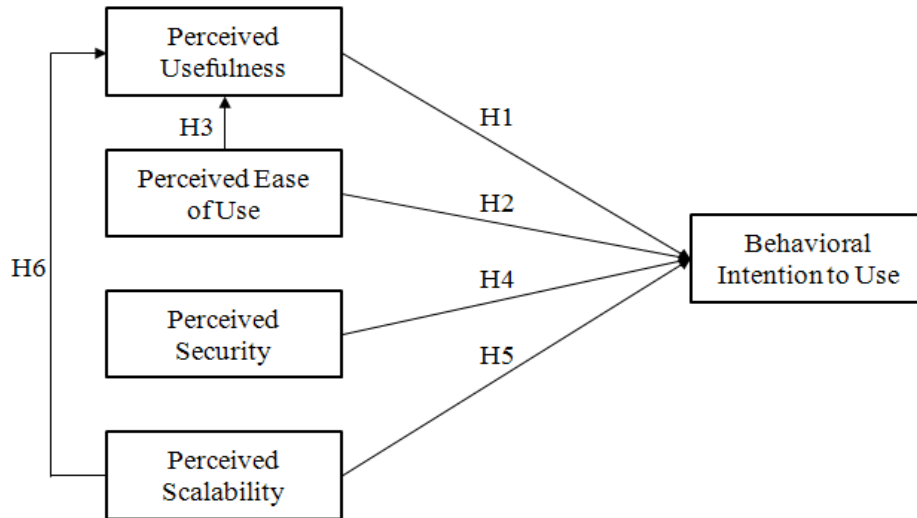


Figure 3. The Proposed Research Model

4. A Case Study

4.1. Data Gathering

Data used to test our research model were gathered from Korean respondents of Korean company users of KT ucloud, SKT Tcloud, LG U+ cloud N, Amazon EC2 and Google Compute Engine (GCE), that is IaaS, which were provided in Korean cloud market as well as global cloud market [1]. We distributed 250 questionnaires and obtained 195 completed which was close to the 190 respondents projected in this research. Each item of the questionnaire was measured on a 7-point Likert scale, ranging from “Strongly Disagree” (1) to “Strongly Agree” (7).

In order to test reliability and validity, we analyzed the data for internal consistency reliability using SPSS 18.0 and AMOS 20.0. This was evaluated by computing Cronbach’s alpha, whose coefficients for the five constructs were greater than 0.7, indicating a reasonable level of internal consistency among the constituent items [17]. In addition, we conducted a confirmatory factor analysis to test the convergent validity of each construct. Convergent validity of the constructs demonstrated that all factor loadings were greater than 0.5 for their own constructs. Therefore, our data were acceptable.

4.2. Hypotheses Testing and Analyzing

All the hypotheses were tested and analyzed for company users. The results of the structural equation modeling are described in Figures 4, and the results of the hypotheses tests are summarized in Table 1. The results of testing analyzing of hypotheses are as follows:

Hypotheses H1, H3 and H4 were supported in that PU and PS had significant positive effect on behavioral intention to use IaaS. PU and PS strongly determined the behavioral intention to adopt IaaS. In addition, the results of the structural equation modeling indicate that PEOU and PSC did not directly influence BIU; i.e., Hypotheses 2 and 5 were rejected. In addition PSC did not positively affect PU.

Table 1. Results of Hypotheses Tests

	Effect	Coefficients	S. E.	Sig.
H1	PU → BIU	0.345	0.085	0.000
H2	PEOU → BIU	0.075	0.069	0.362
H3	PEOU → PU	0.495	0.079	0.000
H4	PS → BIU	0.411	0.063	0.000
H5	PSC → BIU	0.054	0.054	0.548
H6	PSC → PU	0.021	0.062	0.571

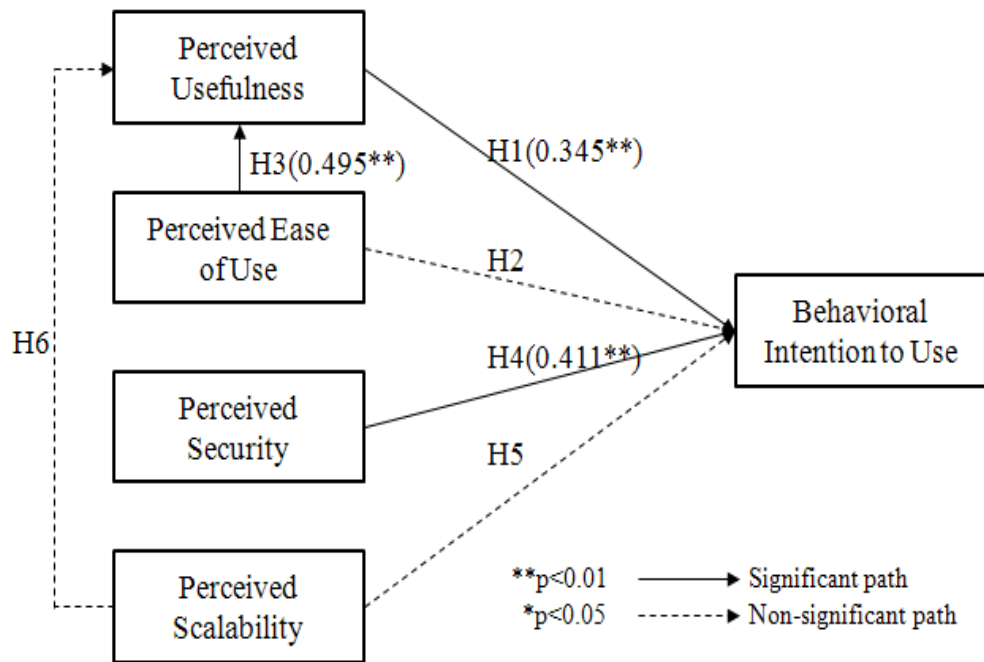


Figure 4. Results of Structural Equation Modeling

4.3. Discussion of Results

There are some meaningful findings of the results of this study as follows:

Firstly, PEOU did not have a direct effect on BIU. That is to say, the PEOU of IaaS among B2B cloud services did not have a direct effect on BI whereas had a direct effect on PU.

Secondly, PS had a significant effect on BUI. This means that company users of IaaS were largely concerned with security.

Finally, PSC did not have an effect on BUI. This means that company users were not largely concerned with scalability. The one of important characteristic of cloud services did not significantly influence the adoption of IaaS.

5. Conclusions

As the global recession has made it more difficult for companies to invest in IT, cloud computing have emerged as a new paradigm in the business IT as green IT. Recently, various types of cloud services of B2B and B2C were deployed and provided in Korea. This paper explored companies' adoption behaviors toward the B2B cloud services focused on IaaS that were recently provided in the Korean B2B cloud market. In order to achieve the goals, we identified key influencing factors that affect the companies' adoption behaviors, based on an extension of the TAM. An exploratory model was proposed and a number of hypotheses were tested and analyzed. According to the results, PU influenced BIU whereas PEOU did not have a direct effect on BIU. PS had an effect on BI but PSC did not have an effect on BIU. This means that company users of IaaS were largely concerned with security but not concerned with scalability. The all characteristics of cloud services did not have an effect on BIU.

The study results can not only help company users gain insights into IaaS adoption, but also help IaaS providers improve both new cloud service development and marketing strategy.

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