



User centric cloud service model in public sectors: Policy implications of cloud services [☆]

Dong-Hee Shin ^{*}

Department of Interaction Science, Sungkyunkwan University, 90327 International Hall, 53 Myeongnyun-dong 3-ga, Jongno-gu, Seoul 110-745, South Korea

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ABSTRACT

This study examines the acceptance of cloud computing services in government agencies by focusing on the key characteristics that affect behavioral intent. The study expanded upon the technology acceptance model by incorporating contextual factors such as availability, access, security, and reliability. The research model was empirically verified by investigating the perception of users working in public institutions. Modeling results showed that user intentions and behaviors were largely influenced by the perceived features of cloud services. Also these features were found to be the significant antecedents of cloud computing usefulness and ease of use. The findings should guide governments' promotion of cloud public services to increase user awareness by enhancing usability and appeal and ensuring security.

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1. Introduction

Cloud computing is one of the rising topics in information technology (IT) today. In fact, there is a growing awareness among consumers and enterprises of the ability to extensively position their IT resources through a utility model that is broadly called cloud computing. This term refers to the internet-based design and use of technology in which the cloud represents the internet (Behrend, Wiebe, London, & Johnson, 2011). The cloud includes a substantial technical infrastructure that users do not need to understand at any level of detail; rather, they only need to connect to it to access its resources (Voi, Light, & Rowland, 2011). Technically, cloud computing enables end-users to access computer software and hardware resources over the internet without the need to have any detailed or specific knowledge of the infrastructure used to deliver those resources (Tian, Lin, & Ni, 2010).

As the diffusion of cloud computing has increased rapidly, the technology is increasingly being adopted in diverse public sectors (Jaeger, Lin, & Grimes, 2008). Companies are leveraging cloud computing to provide increased standardization of IT infrastructure and to increase efficiency in running technologies. While the private sector is fast moving toward the cloud, governments have begun to assess the potentials that this technology would bring. Cloud computing represents a fundamentally different way for government to architect computing resources, allowing governments to leverage powerful IT infrastructures in a fraction of the time it takes to provision, develop, and deploy similar assets in-house. Around the world, governments of Asia Pacific countries are particularly gearing toward cloud computing. For example, cloud computing solutions are also very prevalent in Korea. The Korean

government and private industry together have developed a cloud project named "Next-generation Digital Service in a Cloud Computing Environment" that is aimed at developing and constructing so-called "Cloud storage," a subset of cloud computing. One example of such a project is the N-Screen Service, which enables data sharing on multiple platforms for mobile phones, tablet computers, televisions, and personal computers. It can be said that the surge in smart device has triggered the expansion of the cloud market in Korea.

Along with their phenomenal growth, various cloud computing services have recently suffered from increasing problems of security, privacy, and systematic risk (Lee, Han, Leem, & Yigitcanlar, 2008; Paquette, Jaeger, & Wilson, 2010). In cloud computing, users directly use and operate the software and operating system, and even the basic programming environment and network infrastructure are provided by cloud service providers. Thus, the impact on destruction of the software and hardware cloud resources in cloud computing is worse than those on current internet users. This issue becomes even more critical in the public sector, in which security and reliability are key factors in delivering stable public services (Hamner & Qazi, 2009). Thus, evaluations of user behavior and perceptions of safety are important research topics in cloud computing. For example, concerns about the possible risks of using radio frequency identification (RFID) have increasingly been indicated. Although concerns over cloud computing are not always obvious and direct, risks associated with RFID include the impact of electromagnetic radiation on health and indirect economic consequences such as job elimination through increasing automation (Lee, Lee, & Kong, 2007). The most frequently voiced concern relates to the misuse of data generated by RFID, resulting in an undesirable invasion of individual privacy (Svantesson & Clarke, 2010).

Against rising concerns over security and usability, such issues have only been addressed in a few studies (Hossain & Prybutok, 2008; Jaeger et al., 2008; Thiesse, 2007). In light of such concerns,

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^{*} Fax: +82 2 740 1856.

E-mail address: dshin@skku.edu.

this study explores the factors influencing user perception of cloud computing to theorize its acceptance model. It also applies the theory of reasoned action (TRA) and modifies the technology acceptance model (TAM) to propose a new model that can be used to examine the acceptance of cloud computing. Technology acceptance research has been relatively limited in its application to the public sector. Therefore, there is a concurrent need to develop and gain empirical support for models of technology acceptance within the public sector, and to examine technology acceptance and utilization issues among public employees to improve the success of implementation in this arena. The new model builds upon the existing TAM by integrating contextual and specific features as primary influencing factors. These factors are driven by underlying perceived beliefs, namely benefit, availability, access, and security as enhancing constructs to predict user motivations to accept cloud computing technologies. The three research issues that guide this study are:

RQ1: What perceptions and attitudes exist among public sector officials in Korea that could contribute to, or impede, the acceptance of cloud services?

RQ2: What motivational factors contribute to public sector users' intentions and behaviors regarding cloud computing in the public sector?¹

RQ3: What policy implications can be derived from cloud computing?

This study provides a new framework to identify the antecedents of users' intentions to adopt cloud computing in the public sector. TAM has been criticized for its lack of contextual understanding (Venkatesh & Brown, 2001), a factor that is even more essential in policy implications. It is unclear which specific factors facilitate and/or inhibit user acceptance in cloud computing in the public sector (Loo, Yeow, & Chong, 2009). This study addresses this question by providing structural correlations among the context-specific factors of cloud computing for use in policy provisions.

The findings herein should guide governments in promoting cloud computing services as a way to improve government business and public service. One of the most promising cloud computing opportunities for the public sector is the capacity to share information and communication technology (ICT) resources among various agencies simultaneously. One challenge is the deployment of cloud computing in the public sector featuring secure and user-friendly services (Kshetri, 2010; Zissis & Lekkas, 2011).

So far, the difference between public and private has not been researched enough. Key differences existing between private commercial organizations and public sectors may result in different adoption behaviors of technology acceptance in public sectors. Private commercial organizations are ultimately motivated by maximizing profit whereas public sectors are not. In fact, cloud service is designed to provide more cost effective and efficient governmental services to citizens. Further, other differences between private commercial organizations and public sectors such as organization structure, organizational culture, and social norms, may also result in cloud service adoption in public sectors being different from that in private commercial organizations.

The findings of the present study offer a set of guidelines that will help governments better understand the development of user-perceived features and how they contribute to usability.

2. Trends and concerns

2.1. Global adoption of cloud computing in the public sector

At the present time, cloud computing is becoming increasingly adopted in the worldwide public sector. It is the U.S. that has initiated

cloud computing and it launched a "Cloud First" strategy (Wyld, 2010). This national level of plan has been enabled by the U.S. Federal Budget for 2011, which included cloud computing as a key area of its strategy to realize efficiency and reduce costs.

Cloud adoption in the public sector in China is being driven at the local level in cities such as Dongying and Wuxi. The municipal government plans to transform the city of Dongying from a manufacturing-based economy to a high-tech service-oriented economy. The Yellow River Delta Cloud Computing Center, which is being built by IBM, will provide a cloud-based platform to allow the petroleum industry to develop more innovative application services. Furthermore, the center will provide software development and testing resources through the internet to start ups and other companies that establish their presence in the city. As part of future phases, there are plans to implement a solution that will enable "Smart Roads" and a "Smart Airport" based on data analytics (Wyld, 2010).

The Hong Kong Government is evaluating the use of cloud computing for sharing infrastructure, software components, and data. The government believes that collaboration and communication – internally, between departments, and with citizens – hold maximum potential with a shift to cloud technologies and that this will be one of the focus areas of the cloud strategy. However, the Government will take a cautious approach toward choosing the areas in which cloud computing will be implemented to ensure that data security and privacy are maintained. Adoption of the cloud strategy, which is still a work in progress, will occur over a period of time rather than a big band transformation, the time frame for which has not yet been planned.

The Government of Japan's Ministry of Internal Affairs and Communications (MIC) launched plans to build an all-of-government cloud computing infrastructure as part of a wider "Digital Japan Creation Project." To be built in stages from now until 2015, the MIC intends that the new infrastructure will consolidate all government ICT systems into a single cloud to improve operational efficiency and reduce costs.

Singapore is well positioned to leverage the current investments of market participants, a strong network infrastructure to establish a dominant position in the global cloud computing market. To promote cloud computing in the country, the Infocommunications Development Authority (IDA) of Singapore has begun to design the relevant infrastructure as a primary focus area. IDA has been calling proposals to identify service providers to take up specific infrastructure development projects (Wyld, 2010).

2.2. Justification of Korea as a case study

There are two good reasons that Korea was selected as a case target in this study: (1) cloud service is booming in Korea such that Korea has been the test-bed for new emerging IT services (Shin, 2012); and (2) IT utilization in public sector in Korea has been exemplar such as e-government, e-governance, and IT development index (KCC, 2011; Shin, 2008).

It is known that Korea is the first country in planning to adopt cloud computing, in Asia (Kshetri, 2010). Korea is evolving their infrastructure to take advantage of virtualization and cloud computing. Korea plans to invest 610 billion won in its cloud computing market (about \$522 million U.S.) into the market by 2015 (KCC, 2011). The country's Ministry of Public Administration and Security and the Ministry of Knowledge Economy co-authorized the plan, under which the government plans to quadruple the size of the domestic cloud computing market to 2.5 trillion won (\$2 billion U.S.) and increase its world market share to 10% within four years.

Cloud computing solutions are also a critical part of the Korean government's green technology initiatives that focus on low-power devices for PCs, televisions, displays, and servers. The initial demand for cloud computing will be driven more by government organizations and private companies. The Korean government, nevertheless, seems intent on acquiring a leading role in the establishment of cloud computing. The government has prepared 100 billion won for

¹ A motive is the factor which causes one to act in a particular manner. An intention is an aim or a plan. A motive leads a person to construct so many actions with certain intentions (planned actions), so that the ultimate motive is realized (Venkatesh & Agarwal, 2006).

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