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Beyond user experience of cloud service: Implication for value sensitive approach

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ABSTRACT

With a value-sensitive approach in mind, a theoretical and empirical analysis was conducted and reported here to explain the factors that influence potential user adoption of cloud computing by integrating quality factors as well as cognitive motivations as primary determining factors. The factors are explored as human values and the methodology how designers should take these values into account is examined. The results show that user intentions and behaviors are largely influenced by the perceived values of cloud services, which include availability, access, security and reliability. These values were found to be the significant antecedents of usefulness and ease of use in cloud computing. Theoretically, the model proposed in this paper advances the existing technology acceptance models and can be used to predict the acceptance and diffusion of cloud computing. Practically, the findings should guide the government and industry promoting cloud services to increase user acceptance by enhancing user experience and ensuring security.

1. Introduction

The term cloud computing may still be early to people, but it is gaining popularity steadily. Cloud computing refers to the Internet-based development and use of technology where the cloud represents the Internet (Park and Ryoo, 2013). The cloud includes a substantial technical infrastructure that the users do not need to understand in any level of detail; they just need to connect to it to access its resources (Kim et al., 2013; Voi et al., 2011). Technically, cloud computing enables computer software and hardware resources to be accessed over the Internet without the need for any detailed or specific knowledge of the infrastructure used to deliver the resources, much like a utility model. In this aspect, cloud computing is very similar to a utility model and includes Web 2.0 and numerous other technology models that rely on the Internet or a web browser to access the services (Marston et al., 2011). The services are accessible anywhere in the world, with the cloud serving as a single point of access for all user computing requirements (Jou and Wang, 2013).

While popular in Korea, cloud computing is still in the early stages of development. Cloud computing is wide in its range, and some early types of cloud applications have been used in Korea. The Korean government and industry together have developed a cloud project named "Next-generation digital service in a cloud computing environment," which 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 PCs, televisions and personal computers. N-Screen Services have become very popular in Korea because the number of people who own multiple smart

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gadgets is rapidly increasing. The surge in smart device ownership has triggered the expansion of the N-Screen market in Korea.

There is obviously a lot of hype surrounding cloud computing these days. Due to the phenomenal growth, various cloud computing services have recently suffered from increasing concerns of security, privacy and systematic risk (Joint and Baker, 2011; Yoon et al., 2013). In cloud computing, users directly operate the software and operating system, with the basic programming environment and network infrastructure maintained by cloud service providers. Thus, the impact on and destruction of the cloud software and hardware resources in cloud computing are worse than with current Internet users. Therefore, perceived user safety and the evaluation of user behavior are important research topics in cloud computing.

Despite concerns over security and usability in general, such issues have only been addressed in a few studies (Hossain and Prybutok, 2008; Thiesse, 2007; Yoon et al., 2013). Some of those studies focused on the technical aspects of security (Chae et al., 2006; Kim et al., 2013; Lee et al., 2005) while neglecting user dimensions. Along with technological advancement, it may also be important to comprehensively investigate perceived user security and the perceptions of various features of cloud computing (Park and Ryoo, 2013; Voi et al., 2011). This study explores the factors influencing user perception of cloud computing to theorize the acceptance model of cloud computing. It applies the theory of reasoned action (TRA) and modifies the technology acceptance model (TAM) to propose a new model that can be used to forecast the acceptance of cloud computing. The new model advances the existing TAM by integrating quality factors as well as cognitive variables. These factors are driven by underlying beliefs, namely, perceived benefit, perceived availability, perceived access and perceived security, as enhancing constructs in predicting user motivations to accept technologies provided in cloud computing.

To produce a value-based understanding of cloud computing, which is necessary for its successful assessment, this study starts with user experience and expectation. The findings of this study provide a good basis for the industry by developing a service evaluation framework to determine the adoption potential of new services in the cloud environment. The cloud framework in this study may be a good tool for understanding market potential through an analysis of user needs and prototyping market profiles. From a theoretical perspective, drawing upon the modified TAM, this study provides a new framework to identify antecedents of user intention to adopt cloud computing services. The TAM has been criticized for its lack of contextual understanding (Teo and van Schaik, 2012), which is even more essential for its policy implications. Questions concerning usefulness, ease of use and antecedent effects on perception remain unanswered (Hwang, 2011). This limitation is exacerbated in rapidly emerging technologies like cloud computing. It is unclear which specific factors facilitate and/or inhibit user acceptance in cloud computing. This study addresses this question by providing structural relations among the context-specific factors of cloud computing for use in policy provisions.

From a practical standpoint, the findings should guide designers promoting cloud computing services to improve usability and interface. While Korea has been pioneering information technology (IT), particularly in terms of hardware, other aspects such as software, services and users have been neglected (Shin, 2010). The deployment of cloud computing in Korea with secure and user-friendly services is a current challenge. The findings of the present study offer a set of guidelines that will help the cloud computing industries better understand the development of user-perceived features and how they contribute to usability. The global cloud computing industry is faced with the challenge of providing a safe and stable user environment (Kshetri, 2010). However, adoption patterns and interface designs are rarely examined as qualities in the context of ongoing social practice, that is, *in situ* observations. The findings in this study should be useful for cloud computing designers. First, they could be used after an initial prototype is developed to determine if a particular application would gain extensive long-term user acceptance to justify investing in its further development. Second, the findings of this study could be used to further iterate on a cloud design by identifying weaknesses that need to be addressed in order to increase user acceptance and thus promote diffusion.

The rest of the paper is organized as follows: Section 2 provides a literature review on cloud computing and related social, political, and technical issues; Section 3 proposes the research model and develops the hypotheses tested in this study; Section 4 describes the research method; Section 5 provides the results of empirical tests; Section 6 presents analytical discussions and conclusions along with some implications for practitioners and researchers. Finally, Section 7 presents the limitations of this study and topics for future studies.

2. Literature review

2.1. Cloud computing and its benefits

Cloud computing is a new and promising paradigm delivering IT services as computing utilities. It is becoming more and more popular as large numbers of industries are now using cloud services for their applications (Etro, 2009). Cloud computing is an Internet-based technology through which information is stored in servers and provided as an on-demand service to clients (Behrend et al., 2011). A simpler definition is a system through which IT capabilities are delivered on demand over the Internet, rather than drawn from desktop computers. This is possible because of the cloud infrastructure that consists of reliable services delivered through data centers based on computer and storage virtualization technologies. This structure provides services that facilitate the creation of applications accessible anywhere, with the cloud serving as a single point of access for all of the user's computing requirements (Mell and Grance, 2009).