A Study on User Acceptance of Cloud Computing: A Multi-Theoretical Perspective

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A Study on User Acceptance of Cloud Computing: A Multi-Theoretical Perspective

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ABSTRACT
Extant literature on the adoption of cloud computing has focused on organizational users, but little is known about how individual users accept cloud computing to fulfill individual needs. To fill the gap, this study draws upon multiple theories to examine factors that influence individuals’ intention to use cloud applications. It shows that a person’s attitude toward cloud applications, subjective norm, and perceived behavioral control have direct impacts on the person’s behavioral intention to use the applications. Meanwhile, personal beliefs about the risks and benefits of cloud applications, including privacy and security concerns, concerns about vendor lock-in, perceived vendor reputation, perceived usefulness, perceived ease of use, and perceived transferability of previously learned computer skills, have indirect impacts on behavioral intention. The study is the first to examine individual acceptance of cloud computing from a multi-theoretical perspective. Its implications for research and practice are discussed.

Keywords
Cloud computing, Technology Acceptance Model, Theory of Planned Behavior, computer skill transferability, privacy concerns, security concerns, vendor lock-in.

INTRODUCTION
Cloud computing is “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell and Grance, 2011, p.2). It represents a new trend in developing and delivering IT infrastructure, platform, and software solutions to organizations and individuals (Miller, 2008; Sultan, 2010). Although it is relatively new and still in the inception stage, cloud computing has quickly attracted broad attentions from both developers and users (Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica and Zaharia, 2010), and it is estimated that worldwide spending on cloud computing will grow at an annual rate of 19% through 2015 (McAfee, 2011).

Despite its rapid growth, cloud computing is expected to account for less than 5% of total worldwide IT spending in 2015 (McAfee, 2011) due to various obstacles to its adoption such as business continuity, service availability, data lock-in, and data confidentiality (Armbrust et al., 2010). From both research and practice points of view, it is important to study what factors influence the adoption of cloud computing and how those factors are interrelated. To date, most research on cloud computing adoption has focused on organizational users (Clarke, 2010; Janssen and Joha, 2011; Low, Chen and Wu, 2011; Marston, Li, Bandyopadhyay, Zhang and Ghalsasi, 2011; Sultan, 2011), but little is known about how individual users, such as residents and students, adopt cloud computing for personal use (Ambrose and Chiravuri, 2010). In fact, there are many well-known cloud solutions that are available to individual users, such as Microsoft Co.’s SkyDrive (with Office Web Apps), Apple Inc.’s iCloud, and Google Inc.’s Google Docs, and some of the solutions are even free. With further research and development by established vendors and new entrants, cloud computing will attract more attentions from the public and at the same time competition among the alternative solutions or vendors would be more intensive.

To provide guidance for research and practice, this study examines factors that influence individuals’ acceptance of cloud computing, measured by their behavioral intention to use it to fulfill personal needs. Instead of studying all types of cloud computing, this study focuses on Saas (i.e., Software as a Service) in the public cloud, called public cloud applications or cloud applications (Marston et al., 2011), from the individuals’ perspective. Office Web Apps and Google Docs are both examples of cloud applications. It is expected that cloud applications will render various user benefits such as lower cost in hardware and software, improved document compatibility and reliability, universal document access, and easier group collaboration and file sharing (Miller, 2008). Meanwhile, the potential risks are also noticeable, such as data security and privacy concerns (Miller, 2008), vendor lock-in (Armbrust et al., 2010; Sultan, 2011), and concerns about the training to use...
cloud applications (Koehler, Anandasivam and Dan, 2010). All these factors from different theoretical perspectives predict user acceptance of cloud applications. Therefore, it is important to study across the factors in order to develop a systematic view of their impacts on cloud computing. To this end, this study draws upon multiple theories to examine user acceptance of cloud applications. A research model is developed and empirically tested via a survey on undergraduate and graduate students who are typical computer and internet users. The results of the study and implications for further research and practice are discussed.

The structure of the paper as follows. First, a review on literature and relevant theories is presented, based on which the research model is developed. Then, the empirical method for testing the research model is described, followed by data analysis and hypotheses testing. Finally, the results of the study are discussed, and implications for research and practice are further analyzed.

THEORETICAL BASIS AND RESEARCH MODEL

Consumers are important stakeholders in cloud computing (Marston et al., 2011). Despite a large number of cost and benefit factors recognized (Armbrust et al., 2010; Miller, 2008; Sultan, 2011), only a few have been empirically studied for their impact on individual acceptance of cloud applications, such as perceived usefulness and perceived privacy concerns (Ambrose and Chiravuri, 2010). In fact, individuals may face the same challenges in adopting cloud computing as companies do, so that many factors that were analyzed in organizational research are applicable to individual level, such as privacy and security concerns and vendor lock-in (Janssen and Joha, 2011). In this section, we draw upon multiple theories to analyze the impact of these factors. Figure 1 shows the research model.

**Theory of Planned Behavior**

The theory of planned behavior (Ajzen, 1991) suggests that a person’s intention to conduct a volitional behavior, such as the adoption of cloud computing for personal use, is motivated by three factors: attitude toward the behavior, subjective norm regarding the behavior, and perceived behavioral control (PBC) of the behavior. Attitude refers to an individual's overall evaluation of the performance of the particular behavior, such as the positive or negative outcomes that may emerge while using cloud applications. Subjective norm refers to an individual's perception of social normative pressures, or relevant others' beliefs that he or she should or should not perform such behavior. Perceived behavioral control refers to an individual's perceived ease or difficulty of performing the particular behavior. This theory has been widely adopted in the studies on user acceptance of IT (Pavlou and Fygenson, 2006).

In terms of cloud applications (i.e., Saas), the theory implies that the three antecedents to behavioral intention each have a direct impact on user acceptance of cloud computing. First, attitude toward cloud applications captures the overall assessment
of the expected outcomes of using those applications. Studies show that the use of cloud computing generates various outcomes to the users, including positive outcomes such as lower cost, improved document compatibility and reliability, and universal document access, and also negative outcomes such as data security and privacy concerns and vendor lock-in (Armbrust et al., 2010; Miller, 2008; Sultan, 2011). Many of these outcomes co-exist in a cloud application, suggesting that they together influence the intention of individuals to use it. In fact, attitude is a popular construct in studies on individual IT use (Zhang and Li, 2005), and this construct will continue exerting its impact in the cloud computing era.

The impact of subjective norm was not commonly observed in studies on individual acceptance of IT (Davis, Bagozzi and Warshaw, 1989; Pavlou and Fygenson, 2006), and neither was this construct widely analyzed in the related literature (Zhang and Li, 2005). Nevertheless, this situation is about to change in the cloud era, as one of the most important features of cloud computing, compared to traditional computing, is its ability to support online collaboration. This determines that an individual, when choosing whether to use cloud computing and what application to use, will normally consider opinions or requirements of the peers in order to make online collaboration and file sharing feasible. To date, file inter-operability across cloud applications is still limited (Armbrust et al., 2010), so that subjective norm will influence what application a user may choose for collaboration purposes.

Finally, perceived behavioral control will extend its impact on cloud application adoption due to various challenges in using cloud applications as mentioned above. These challenges suggest that individuals with higher levels of perceived behavioral control would be willing to try various features of the cloud applications. Therefore, we hypothesize:

H1: A person’s attitude toward cloud applications has a positive impact on the person’s behavioral intention to use the applications.

H2: Subjective norm regarding cloud applications has a positive impact on a person’s behavioral intention to use the applications.

H3: A person’s perceived behavioral control of using cloud applications has a positive impact on a person’s behavioral intention to use the applications.

**Technology Acceptance Model**

Technology Acceptance Model (TAM) provides the theoretical basis to pinpoint two critical factors that influence the attitude toward IT adoption: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis et al., 1989; Pavlou and Fygenson, 2006). PU refers to a prospective user’s subjective probability that using a specific application system will increase his or her job performance within a context, and PEOU refers to the degree to which the prospective user expects the target system to be free of effort (Davis et al., 1989). This theory suggests that PU and PEOU both influence the attitude toward using the IT, and PU also has a direct impact on behavioral intention; meanwhile, PEOU has an impact on PU.

In terms of cloud computing, this theory implies that a person’s PU and PEOU of cloud computing will influence the person’s attitude toward using cloud computing, and PU also has a direct impact on behavioral intention to use it. In fact, PU can be considered a summative factor of various benefits of using cloud applications as mentioned above (Miller 2008). People use cloud applications for different purposes: to use the needed application features such as file editing, storing, and sharing; to access to files from virtually everywhere; and to save cost by using the free solutions, etc. While it would be valuable to recognize what benefits a user is looking for in a given situation, for generalization purpose, we use PU as a summative indicator of the various benefits that the user may expect in using cloud applications, and hypothesize:

H4: A person’s perceived usefulness (PU) of cloud applications has a positive impact on the person’s attitude toward the applications.

Meanwhile, other relationships in TAM are applicable to the cloud computing context. First, we expect that PEOU would influence the attitude toward cloud applications. A key feature of many IT applications is to save people’s efforts of learning and using the applications, which is also true for cloud applications. For example, with the application hosted on the provider’s website, the user does not need to worry about installation and upgrading issues. Also, the user has universal access to the files as long as an internet connection is available, and this access is device-independent as it usually requires a web browser or a lighter version of desktop or mobile application. Other conveniences include easier group collaboration and file sharing (Miller, 2008). All these features make the use of cloud computing easier than the traditional desktop or mobile
computing, and would positively influence the person’s attitude toward it. Second, we expect that PU of cloud applications may have a direct impact on behavioral intention. Davis et al. (1989) show that attitude only partially mediates the impact of PU on behavioral intention, which may explain the difficulties of accurately capturing attitude toward a behavior within a context, an issue that behavioral scientists admit (Ajzen, 2001). While it goes beyond the scope of this study to address the issue, the case is that users may still choose to use a cloud application despite the negative word-of-mouth of it such as poor ratings. Third, we expect that PEOU of a cloud application would have an impact on PU: when the user experiences fewer difficulties in learning and using the cloud application and its features, he or she may find the application more useful. Therefore, we hypothesize:

**H5:** A person’s perceived ease of use (PEOU) of cloud applications has a positive impact on the person’s attitude toward the applications.

**H6:** A person’s perceived usefulness (PU) of cloud applications has a positive impact on the person’s behavioral intention to use the applications.

**H7:** A person’s perceived ease of use (PEOU) of cloud applications has a positive impact on the person’s perceived usefulness (PU) of the applications.

**Concerns about Transferability of Computer Skills**

Compared to other forms of computing such as desktop computing and mobile computing, cloud computing is relatively new. This determines that potential users of cloud applications have already acquired certain skills of using the applications on a desktop or mobile device. Correspondingly, the transferability of their previously learned computer skills to cloud applications would influence how they feel about the latter. Koehler et al. (2010) point out that cloud computing services can be either easy or complex to use, so that training is required for some services whereas for others it is not needed. From a cost-benefit perspective, individuals would prefer to use a cloud application that gives them the same or similar experience as in the traditional desktop and mobile computing environments so that minimum training or learning is needed to use the features. Li and Chang (2011), in addressing computer skills transfer in learning new applications, show that if the new and the previously learned applications share common features such as interface, function and syntax, the perceived transferability of skills would be high. This seems to be the case because many cloud computing solutions, as some industry leaders point out, mimic existing desktop solutions (Armbrust et al., 2010). Therefore, we hypothesize:

**H8:** A person’s perceived transferability of computer skills from previous learned desktop or mobile applications to cloud applications has a positive impact on the person’s perceived ease of use of the cloud applications.

**Trust in Cloud Computing**

Trust is a critical factor in the internet and e-commerce environment. It is crucial wherever risk, uncertainty, and/or interdependence exist (McKnight and Chervany, 2002). Although cloud computing provides various benefits to the users, it comes with a price, including various risks such as privacy risks, security risks, integrity risks, availability risks, user control risks, risks of vendor lock-in, and risks of performance latency (Sultan, 2010; Zissis and Lekkas, 2012). These risk factors all influence how trustworthy a cloud application (or its vendor) is. From the theory of planned behavior perspective, these risks indicate the user’s expectation of negative behavioral outcomes of using cloud computing and the evaluation (such as severity) of the outcomes, and together they determine an overall assessment of the risk level of using cloud applications. While a detailed analysis of the various risk expectations and assessments is presented in the next sections, we believe that perceived risk of using cloud applications is a summative indicator of the various risk factors, which would have a negative impact on the person’s attitude toward the applications. Therefore, we hypothesize:

**H9:** A person’s perceived risk of using cloud applications has a negative impact on the person’s attitude toward the applications.

There are a number of mechanisms that cloud application providers may adopt to address users’ risk concerns, such as data encryption and account control. Nevertheless, these technological solutions only address some of the risk issues but not all, as many other risks are related to how the providers effectively adopt the solutions to create a trusted computing environment. To evaluate how effectively a provider reduces the various risks, a popular indicator would be the reputation of the provider (Koehler et al., 2010), which measures the general belief that the provider would behave as promised or expected. As there are many different cloud applications available, it is infeasible for the users to try those applications in order to gauge the
potential risks. Therefore, the reputation of the provider, especially the perceived reputation by the user, would have a positive impact on the trusting attitude on the provider. Therefore, we hypothesize:

H10: A person’s perceived reputation of the provider of cloud applications has a positive impact on the person’s attitude toward the applications.

Privacy and Security Concerns about Cloud Computing

Two of the most broadly recognized risk factors in cloud computing are privacy concerns and security concerns (Cheng and Lai, 2012; Janssen and Joha, 2011; Subashini and Kavitha, 2011; Ryan, 2011; Svantesson and Clarke, 2010). Ironically, although cloud computing was originally designed to address some of the privacy and security issues by reducing the physical equipments at the user’s end and managing the computing environment by more experienced providers, it causes its own problems of privacy and security, especially when the provider does not fully protect or respect users’ data (Svantesson and Clarke, 2010). This happens because user data are hosted by an external provider, who may take opportunistic behaviors such as unauthorized access to the data without users’ explicit consent. Because of the existence of such possibilities, privacy and security concerns exist (Hoffman, Novak and Peralta, 1999).

While legislators are making laws and regulations to nurture a risk-free online environment, such as the pass of Customer Privacy Bill of Rights by the United States government in February 2012, a complete protection of user data is still beyond reach. Therefore, scholars such as Classen and Fogarty (2012) suggest that a prudent end user should conduct due diligence on the cloud provider’s security practices. Correspondingly, we expect that both privacy concerns and security concerns would have an impact on users’ attitudes toward cloud applications, and we hypothesize:

H11: A person’s security concerns about cloud applications have a positive impact on the person’s perceived risk of the applications.

H12: A person’s privacy concerns about cloud applications have a positive impact on the person’s perceived risk of the applications.

Concerns about Vendor Lock-in

The last factor we study in this research is the concern about vendor lock-in. Also called data lock-in, it refers to the difficulties of the users to transfer data and programs from one cloud provider to another or in-house (Koehler et al., 2010; Nuseibeh, 2011; Sultan, 2011). According to a study by Armbrust et al. (2010), data lock-in is one of the top ten obstacles to the growth of cloud computing. They point out that the storage for cloud computing is still essentially proprietary, so that customers cannot easily extract their data and programs from one provider to run on another. Correspondingly, users are vulnerable to price increases (such as subscribing to premium services), reliability problems (such as service outage or latency), or even providers going out of business. All these augment users’ risks of using cloud computing applications. Hence, we hypothesize:

H13: A person’s concern about vendor lock-in has a positive impact on the person’s perceived risk of cloud applications.

RESEARCH METHOD

Research Design

To empirically test the research model, a survey was designed to collect data from individual users. A total of 225 students at a leading private university in Taiwan were invited to the study, including 204 undergraduate students and 21 graduate students. Before the participants filled out the survey questionnaire, they were given a presentation on cloud computing. The participants were then asked to use either Google Docs or Office Web Apps to complete a spreadsheet task designed by the researchers. Instructions on how to access Google Docs or Office Web Apps were also provided. The participants were specifically reminded that when the task was completed and saved, the documents would not be kept on the local computer as usual but in a remote server hosted on Google.com or Officelive.com. After the designated tasks were completed, the survey questionnaires were administered to the students. Of the 225 participants, 222 completed the questionnaires that were deemed usable. Table 1 presents the demographic information of the respondents in the sample.

As revealed in Table 1, 55.9% of the respondents are male and 41.9% are female. Over 90% of the respondents are aged less than 30 years old. On average, the respondents have 10.1 years of experience in internet use, and over 90% of them have an
experience over 5 years. Overall, the respondents spent 6.1 hours on the internet every day. More than 40% of the respondent spent over 6 hours surfing internet per day. This sample of savvy internet users is suitable for testing the research model.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>55.9%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>41.9%</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>2.2%</td>
</tr>
<tr>
<td>Age</td>
<td>&lt; 20 years old</td>
<td>50 %</td>
</tr>
<tr>
<td></td>
<td>21-30 years old</td>
<td>41.4%</td>
</tr>
<tr>
<td></td>
<td>31-39 years old</td>
<td>7.2%</td>
</tr>
<tr>
<td></td>
<td>&gt; 40 years old</td>
<td>0.9%</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>0.5%</td>
</tr>
<tr>
<td>User Computer Experience</td>
<td>&lt; 5 years</td>
<td>1.8%</td>
</tr>
<tr>
<td></td>
<td>6-10 years</td>
<td>49.5%</td>
</tr>
<tr>
<td></td>
<td>11-15 years</td>
<td>37.4%</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years</td>
<td>10.8%</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>0.5%</td>
</tr>
<tr>
<td>Users’ Internet Experience</td>
<td>&lt; 5 years</td>
<td>2.7%</td>
</tr>
<tr>
<td></td>
<td>6-10 years</td>
<td>61.7%</td>
</tr>
<tr>
<td></td>
<td>11-15 years</td>
<td>31.9%</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 years</td>
<td>3.2%</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>0.5%</td>
</tr>
<tr>
<td>Users’ Average Time on Internet per day</td>
<td>&lt; 5 hours</td>
<td>55.8%</td>
</tr>
<tr>
<td></td>
<td>6-10 hours</td>
<td>35.6%</td>
</tr>
<tr>
<td></td>
<td>11-15 hours</td>
<td>5.8%</td>
</tr>
<tr>
<td></td>
<td>&gt; 16 hours</td>
<td>2.3%</td>
</tr>
<tr>
<td></td>
<td>Unspecified</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Table 1. Demographic Analysis

Measurement Items

All the constructs in the research model are latent constructs and are each measured by a group of manifest variables. Most of the measurement items were adopted from existing literature, except for concerns about vendor lock-in, which was derived from literature as there was no empirically tested measurement instrument. Table 2 presents the items. All the manifest variables were measured with a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7). The psychometric properties of the items were tested in the next section.

<table>
<thead>
<tr>
<th>Items and Sources</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behavioral intention to use cloud applications</strong> (CR= 0.97; Alpha= 0.96) (Venkatesh and Bala, 2008; Venkatesh, Morris, Davis and Davis, 2003)</td>
<td></td>
</tr>
<tr>
<td>1. I am willing to try it (such as Google Docs) out shortly.</td>
<td>0.93</td>
</tr>
<tr>
<td>2. I am willing to perform some of my current computer tasks through Cloud Computing.</td>
<td>0.94</td>
</tr>
<tr>
<td>3. I am willing to use cloud applications (such as Google Docs) in the future to accomplish tasks.</td>
<td>0.96</td>
</tr>
<tr>
<td>4. I am willing to use cloud applications (such as Google Docs) in the future to improve my job performance.</td>
<td>0.95</td>
</tr>
<tr>
<td><strong>Attitude toward cloud applications</strong> (CR= 0.96; Alpha= 0.94) (Venkatesh et al. 2003)</td>
<td></td>
</tr>
<tr>
<td>1. Using cloud applications (such as Google Docs) is a bad/good idea.</td>
<td>0.93</td>
</tr>
<tr>
<td>2. Using cloud applications (such as Google Docs) is foolish/wise.</td>
<td>0.92</td>
</tr>
<tr>
<td>3. Using cloud applications (such as Google Docs) is a negative/positive.</td>
<td>0.93</td>
</tr>
<tr>
<td>4. Using cloud applications (such as Google Docs) is harmful/beneficial.</td>
<td>0.93</td>
</tr>
<tr>
<td><strong>Subjective norms regarding cloud applications</strong> (CR= 0.92; Alpha= 0.87) (Venkatesh and Bala, 2008)</td>
<td></td>
</tr>
<tr>
<td>1. People I know think that I should use cloud applications (such as Google Docs).</td>
<td>0.88</td>
</tr>
<tr>
<td>2. People I know are helpful in the use of cloud applications (such as Google Docs).</td>
<td>0.89</td>
</tr>
<tr>
<td>3. People I know can provide support to the use of cloud applications (such as Google Docs).</td>
<td>0.90</td>
</tr>
<tr>
<td><strong>Perceived behavioral control of cloud applications</strong> (CR= 0.97; Alpha= 0.96) (Xu, Dinev, Smith and Hart. 2011)</td>
<td></td>
</tr>
<tr>
<td>1. When using cloud applications (such as Google Docs), I have control over who can get access to my information.</td>
<td>0.93</td>
</tr>
<tr>
<td>2. When using cloud applications (such as Google Docs), I have control over what information about me is released by</td>
<td>0.96</td>
</tr>
</tbody>
</table>
the websites.

3. When using cloud applications (such as Google Docs), I have control over how my information is used by the websites. 0.95

4. Overall, I have control over my information during the use of the cloud applications (such as Google Docs). 0.92

**Perceived ease of use** (CR= 0.92; Alpha= 0.89)  
(Venkatesh, 2000)

1. My interaction with the cloud applications (such as Google Docs) is clear and understandable. 0.82
2. Interacting with the cloud applications (such as Google Docs) does not require a lot of my mental effort. 0.86
3. I find cloud applications (such as Google Docs) to be easy to use. 0.93
4. I find it easy to get the cloud applications (such as Google Docs) to do what I want them to do. 0.86

**Perceived usefulness** (CR= 0.96; Alpha= 0.95)  
(Venkatesh, 2000)

1. Using the cloud applications (such as Google Docs) improves my performance in my job. 0.93
2. Using the cloud applications (such as Google Docs) in my job increases my productivity. 0.93
3. Using the cloud applications (such as Google Docs) enhances my effectiveness in my job. 0.96
4. I find the cloud applications (such as Google Docs) to be useful in my job. 0.91

**Perceived transferability of computer skills** (CR= 0.95; Alpha= 0.94)  
(Li and Chang, 2011)

1. My skills learned from desktop applications (such as Microsoft Office) are helpful in learning how to use cloud applications (such as Google Docs). 0.77
2. My knowledge of desktop applications (such as Microsoft Office) saves efforts in learning cloud applications (such as Google Docs). 0.77
3. I can apply the skills I learned from desktop applications (such as Microsoft Office) to the use of cloud applications (such as Google Docs). 0.84
4. The skills I learned from desktop applications (such as Microsoft Office) can be reused in cloud applications (such as Google Docs). 0.87
5. My knowledge of desktop applications (such as Microsoft Office) can be applied to my understanding of the features of cloud applications (such as Google Docs). 0.88
6. The knowledge I possess from learning desktop applications (such as Microsoft Office) enables me to spend less time to learn cloud applications (such as Google Docs). 0.89
7. My skills in desktop applications (such as Microsoft Office) are helpful in recognizing the features of cloud applications (such as Google Docs). 0.89
8. My skills in desktop applications (such as Microsoft Office) enable me to find the needed features of cloud applications (such as Google Docs) to solve a problem. 0.87

**Perceived risks** (CR= 0.93; Alpha= 0.89)  
(Pavlou, Liang and Xue. 2007)

1. I feel that using cloud applications (such as Google Docs) involves a high degree of uncertainty. 0.92
2. I feel that using cloud applications (such as Google Docs) is associated with high risks. 0.92
3. I feel that the results of using cloud applications (such as Google Docs) can be unpredictable. 0.88

**Perceived reputation of the provider** (CR= 0.91; Alpha= 0.87)  
(Casalo et al. 2007)

1. This website has a good reputation. 0.86
2. This website has a good reputation compared to other rival websites. 0.85
3. This website has a reputation for offering quality cloud computing services. 0.86
4. This website has a reputation for being respectful to its customers. 0.83

**Perceived security concerns** (CR= 0.91; Alpha= 0.86)  
(Pavlou et al. 2007)

1. I feel insecure in providing personal information when using cloud applications (such as Google Docs). 0.83
2. I feel unsafe in saving personal information with cloud applications (such as Google Docs). 0.90
3. The security issue of personal information is a major obstacle for me to use cloud applications (such as Google Docs). 0.74
4. Overall, cloud applications (such as Google Docs) are unsafe places to send personal information. 0.89

**Perceived privacy concerns** (CR= 0.94; Alpha= 0.92)  
(Pavlou et al. 2007)

1. I am concerned that using cloud applications (such as Google Docs) allows the providers to collect too much information about me. 0.83
2. It bothers me when the providers of cloud applications (such as Google Docs) ask me for personal information. 0.78
3. I am concerned about my privacy when using cloud applications (such as Google Docs). 0.90
4. I have doubts as to how well my privacy is protected by the providers of cloud applications (such as Google Docs). 0.85
5. My personal information could be misused when using cloud applications (such as Google Docs). 0.86
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Table 2. Construct Items and Reliability Measures

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Cronbach’s (\alpha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>My personal information could be accessed by unknown parties when using cloud applications (such as Google Docs).</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Concerns about vendor lock-in</td>
<td>(CR= 0.91; Alpha= 0.85) (Armbrust et al. 2010 and Sultan, 2011)</td>
<td></td>
</tr>
<tr>
<td>1. I am concerned that it would be difficult for me to switch to other vendors of cloud applications in the future.</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>2. I am concerned that the cost of switching to other vendors of cloud applications in the future would be very high.</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>3. I am concerned that the loss incurred by switching to other vendors of cloud application in the future would be formidable.</td>
<td>0.91</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Construct Items and Reliability Measures

DATA ANALYSIS AND RESULTS

We follow the guidelines by Gefen, Rigdon and Straub (2011) to conduct the analysis. First, the measurement model is tested to assess the psychometric properties of the measurement items. As shown in Table 2, Cronbach’s \(\alpha\) ranged from 0.85 to 0.96, indicating that the measurements were reliable. Composite Reliability (CR), the Average Variance Extracted (AVE) and item loadings were all above the recommended levels (Gefen et al., 2011). The results suggested strong convergent validity. In addition, the square roots of AVE in Table 3 are greater than the corresponding inter-construct correlations. Moreover, the loadings to a latent variable that an item intends to measure are greater than those to other latent variables, suggesting the lack of cross-loading and adequacy of discriminant validity.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attitude</td>
<td>5.04</td>
<td>1.08</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Perceived behavioral control</td>
<td>5.22</td>
<td>1.40</td>
<td>0.26</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Perceived ease of use</td>
<td>4.39</td>
<td>1.30</td>
<td>0.52</td>
<td>0.25</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Intention</td>
<td>4.91</td>
<td>1.72</td>
<td>0.69</td>
<td>0.37</td>
<td>0.39</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Vendor lock-in</td>
<td>4.72</td>
<td>1.24</td>
<td>0.02</td>
<td>0.20</td>
<td>0.15</td>
<td>0.05</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Privacy concerns</td>
<td>5.25</td>
<td>1.35</td>
<td>-0.04</td>
<td>0.20</td>
<td>0.08</td>
<td>0.00</td>
<td>0.33</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Reputation</td>
<td>4.59</td>
<td>1.28</td>
<td>0.29</td>
<td>0.29</td>
<td>0.23</td>
<td>0.28</td>
<td>0.17</td>
<td>0.21</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Risk concerns</td>
<td>4.68</td>
<td>1.24</td>
<td>-0.09</td>
<td>0.06</td>
<td>0.01</td>
<td>-0.12</td>
<td>0.31</td>
<td>0.49</td>
<td>0.18</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Subjective norm</td>
<td>4.48</td>
<td>1.08</td>
<td>0.62</td>
<td>0.30</td>
<td>0.34</td>
<td>0.59</td>
<td>-0.02</td>
<td>0.00</td>
<td>0.15</td>
<td>-0.16</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Security concerns</td>
<td>4.84</td>
<td>1.46</td>
<td>-0.08</td>
<td>0.15</td>
<td>0.06</td>
<td>-0.08</td>
<td>0.20</td>
<td>0.71</td>
<td>0.14</td>
<td>0.52</td>
<td>-0.10</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Skill transfer</td>
<td>4.79</td>
<td>1.28</td>
<td>0.40</td>
<td>0.35</td>
<td>0.55</td>
<td>0.33</td>
<td>0.21</td>
<td>0.21</td>
<td>0.24</td>
<td>0.07</td>
<td>0.36</td>
<td>0.19</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>12. Perceived usefulness</td>
<td>4.77</td>
<td>1.16</td>
<td>0.62</td>
<td>0.22</td>
<td>0.50</td>
<td>0.60</td>
<td>0.16</td>
<td>-0.02</td>
<td>0.18</td>
<td>-0.05</td>
<td>0.45</td>
<td>-0.05</td>
<td>0.33</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Note: Square roots of the average variance extracted are shown on the diagonal of the matrix.

Table 3. Convergent and Discriminant Validity

SmartPLS 3.0 (Ringle, Wende and Will, 2005) was used to estimate the structural model. The bootstrapping approach was used to generate 200 random samples of observations from the original data set to assess the significance of the path coefficients. Figure 2 presents the results of the analysis. The results show that all hypotheses proposed in this study are supported at a significance level of .05 or better. The results also show that cloud computing security, privacy concerns, and vendor lock-in together explain nearly 33% of the variance of users’ perceived risk. Users’ perceived risk, perceived reputation of the provider, perceived ease of use and perceived usefulness of the cloud application explain 48% of the variance in users’ attitude toward the use of the application. In addition, users’ attitude, subjective norm and perceived behavioral control explained 59% of the variance of intention to use cloud computing.

DISCUSSION AND CONCLUSION

In this study, we analyze factors that influence individuals’ acceptance of cloud applications from a multi-theoretical perspective. We study the influential factors based on theory of planned behavior, technology acceptance model, computer learning theories, and social and economic exchange theories. For the social and economic exchange theories, we analyze the roles of security concerns, privacy concerns, concerns for vendor lock-in, and also the reputations of the vendors. The results show that these factors have significant impacts on a person’s attitude toward cloud applications, which is consistent with the theory of planned behavior. The model explains a substantial amount (59%) of variance in the behavioral intention construct, suggesting that the study has significant implications.

For research, this study is the first to analyze the adoption of cloud computing by individual users. As mentioned earlier, most research in the area of cloud computing has focused on organizations, but little is known about how individuals respond to this new trend of computing except for some qualitative discussions. The study therefore fills the gap by providing empirical evidence of their impacts. Importantly, through the lenses of multiple theories, the study shows that several factors.
have an impact on cloud computing acceptance, suggesting that further research could be conducted to explore additional factors that were not included in this study. Finally, the study shows that theory of planned behavior, which has been widely applied in IS research, is still a solid basis for cloud computing studies. This helps to extend IS research from the traditional online or offline environment to the cloud environment.

For practice, the study shows that both personal reasons (i.e., attitude and behavioral control) and peer pressure (i.e., subjective norm) are significant predictors of behavioral intention. This implies that for cloud vendors to effectively promote their products they should look at the influence of opinion leaders or reference groups of a person, which may enhance the person’s acceptance of cloud computing. Also, the transferability of previously learned computer skills should not be overlooked, as the results show that it directly influences perceived usefulness of cloud applications. This suggests vendors develop cloud applications that match users’ pre-existing behavioral patterns. In addition, the negative impact of risk factors, including concerns for privacy, security and vendor lock-in, should also be considered when providing the service. Particularly, although existing vendors prefer proprietary data formats for various reasons, they should not overlook the market potential for interoperable data or programs. As the competition intensifies, the format that is supported by more will survive.

REFERENCES