

# An Empirical Study to Examine Drivers of Personal Cloud Computing Usage

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## ABSTRACT

Cloud computing is recognized as an important area for information technology (IT) innovation and investment. Many companies are rapidly reorienting their overall IT strategies to include cloud computing. Cloud computing reduces the cost of IT since there is no installing, maintaining, or updating software as well as the elimination of IT emergencies or working after hours. Despite the potential for positive change, there are still other factors to consider before cloud computing can be accepted entirely by the individual, large business, or academic group. Therefore, the main objective of this study is to examine how individuals perceive cloud computing. The study findings reveal several factors which play an important role in their decision whether to adopt cloud computing technology. This study will contribute to the literature by proposing and empirically testing factors that impact the intention to adopt cloud computing.

## KEYWORDS

Cloud Computing, Normative Beliefs, Perceived Cost, Perceived Security, Perceived Speed, Technology Acceptance Model (TAM), Technology Competency

## INTRODUCTION

Cloud computing has had a dramatic impact on the way businesses handle IT (Fan et al., 2015). The importance of investment in cloud computing technology for conducting business has been widely recognized (Said et al., 2017). Cloud technology has spurred the interest of businesses and researchers alike with its ability to revolutionize traditional IT delivery with reduced costs, greater elasticity, and ubiquitous access (Hsu et al., 2014). According to a recent worldwide survey in 2020, 49 percent of respondents state that they plan to deploy a hybrid cloud model within three to five years (Statista, 2021).

Few will argue that data has become the lifeblood of organizations. Thus, preserving digital data for the long-term is a crucial and challenging task in the light of rapidly changing technologies and the associated risk of media degradation and obsolete soft/hardware (Burda & Teuteberg, 2016). Fortunately, cloud computing may be the answer to the storage and processing of digital data. The

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cloud computing model has been increasing in its popularity due to its various benefits such as cost-effectiveness, scalability, usefulness, ease of use, and its anywhere, anytime accessibility.

The benefits and risks of organizations migrating to a cloud are frequently discussed in business literature and many of those same benefits are also available to individual consumers who use cloud computing services. There are many benefits recognized when changing to cloud computing, among the most common is that of no or low cost (Das et al., 2013). Cloud computing is cost effective and can sometimes even be free, depending on the services needed (Changchit & Chuchuen, 2018).

Individual users of cloud computing enjoy similar benefits as organizations. These benefits include anywhere/anytime access, cost savings, extra data storage space, and having the cloud resources serve as an external back-up copy of their data. With today's Internet and computer technology, there are virtually no performance differences between using cloud computing resources versus storing data and running applications on the local computer. Cloud computing enables a shift from local computing resources to Internet-based services that can be accessed anywhere, anytime and on a variety of devices.

Cloud computing can be categorized into three types of services. The first type of cloud computing service is Infrastructure as a Service (IaaS) that offers networking, storage space, and computer hardware. The second type of cloud computing service is that of Software as a Service (SaaS) where software applications are hosted, maintained, and updated on the cloud providers servers for their customers to remotely access and use from multiple devices. The third type of cloud computing service is that of Platform as a Service (PaaS) which is a service where the cloud vendor provides application development tools and operating systems. The cloud services of IaaS and SaaS are the services most likely to be used by individual users. The IaaS is the most popular service used by individual cloud users because it includes data storage capacity where individual users can back-up their data and/or store their data to allow for anywhere, anytime access to that data. SaaS is also used by individual users to host applications that can also be accessed anywhere, anytime from a variety of devices.

Although several prior studies have examined the factors that influence the adoption of cloud computing in organizations (e.g., Lin & Lin, 2019; Matias, & Hernandez, 2021; Ming et al., 2018; Priyadarshinee et al., 2017; Shen et al., 2020), few research studies have focused on factors that influence individual consumers to adopt cloud computing for personal use (e.g., Gkika et al., 2020; Ratten, 2015). Senyo, Addae, & Boatenga (2018) examined studies from 2009 through 2015 that focused on cloud computing adoption and reported that only 8 percent of the studies focused on individual adoption. While cloud computing provides many benefits and the potential for positive change, not all consumers are ready to adopt this technology. Therefore, this study will center on cloud computing adoption by the individual consumer. The study findings should contribute to the currently sparse literature in individual consumer adoption of cloud computing.

## **LITERATURE REVIEW**

Many new technological innovations such as cloud computing can be attributed to the increasing demand for more advanced and efficient technology. There are a variety of personal cloud storage services, such as Dropbox, Google Drive, OneDrive, Mega, iCloud, and SkyDrive, with different free and paid capacities that users can utilize depending on their needs and budget (Ghaffari & Lagzian, 2018). The most popular use of cloud computing by the individual consumer is that of cloud storage. With cloud storage, data and files are stored and processed at a remote location instead of a local computer. Individual users can access the files from multiple devices, can share the files with others, and can use cloud storage as a file backup (Song et al., 2020). The popularization of cloud computing by companies like Amazon®, Google®, and Apple® ensure that the usage of the cloud as a storage medium for music, movies, and other media content files, will be ubiquitous in the next 10 years (Changchit, 2014).

Prior studies have used the Technology Acceptance Model (TAM) to explain the individual adoption of cloud computing. For instance, Wang (2016) reported that the factors of perceived

usefulness, individual innovation, perceived trust, perceived ease of use, and subjective norms influenced the individual's intention to adopt cloud computing. A study by Arpaci (2016) also reported that perceived usefulness, subjective norm, and trust positively influence individual cloud adoption. A mobile cloud computing study by Park and Kim (2014) reported that perceived ease of use, perceived usefulness, service quality, system quality, and information quality, all influenced behavioral intention.

The Unified Theory of Acceptance and Use of Technology (UTAUT) has also been used in the study of individual consumer adoption of cloud computing. The UTAUT is thought to provide a more comprehensive view of technology acceptance (Venkatesh et al., 2003). A study by Moryson and Moeser (2016) employed the UTAUT and found that social influence, performance expectancy, effort expectancy, and perceived security risks were significant in the adoption of cloud computing. Also using the UTAUT, a study by Ali et al. (2019) found that performance expectancy, effort expectancy and social influence positively influenced behavior intention to adopt cloud computing while privacy concerns and perceived internet privacy risks negatively influenced individual user's behavior intention. Another study conducted by Sharma et al (2016) reported that job opportunity, trust, perceived usefulness, self-efficacy, and perceived ease of use as the best predictors of cloud computing adoption.

To date researchers have focused a significant amount of attention on cloud computing adoption at the organizational level. However, despite the advantages of cloud storage compared to conventional storage media, prior research on individual adoption indicates that users do not take full advantage of cloud storage services (Burda & Teuteberg, 2016). Before implementing this technology, it is crucial to understand which factors can encourage or discourage users from adopting cloud computing. The findings in this study will help cloud computing service providers, understand which factors encourage or discourage potential users intention to adopt cloud computing, thus increasing the chance for the successful rendering of cloud computing services. In addition, this study will add to the existing but limited body of research that focuses on the adoption of cloud computing among individual consumers.

## **THEORETICAL DEVELOPMENT AND RESEARCH MODEL**

TAM has seen successful and widespread usage in many different disciplines and thus was used as a framework for this study. This study extends the TAM to include five additional factors predicted to play a significant role in individual cloud computing adoption. These factors are: (1) Technology Competency (TC), (2) Perceived Security (PS), (3) Perceived Speed of Access (PSA), (4) Perceived Cost of Usage (PCU) and (5) Normative Beliefs (NB). The proposed research model is shown in Figure 1.

### **Technology Competency (TC)**

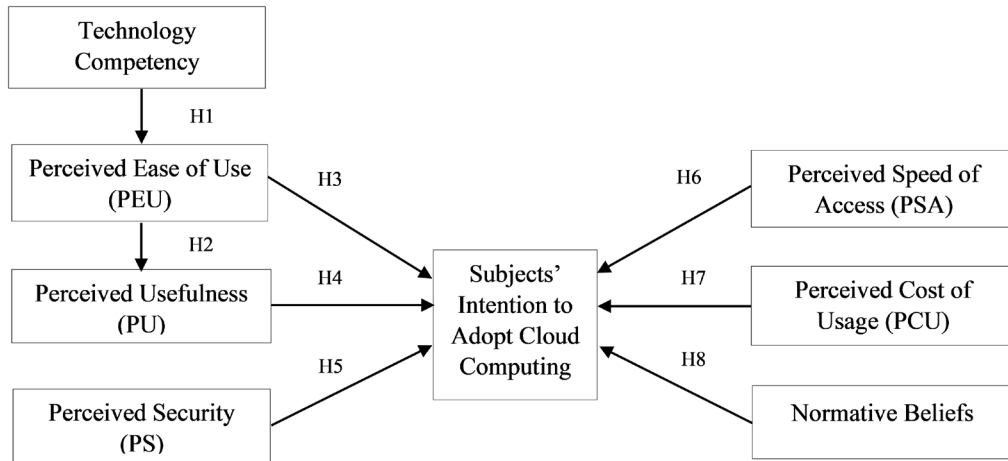
Technology Competency is defined as an individual's assessment of their capability to use computers in a variety of situations (Hsia et al., 2014). People with greater technology competency tend to seek out various technologies to use to accomplish their tasks since they have a higher level of confidence in their ability to accomplish the tasks on a computer. Thus, it is likely that technology competency could also be related to cloud computing adoption among individual consumers. We therefore propose that:

**H1:** Technology Competency (TC) positively affects subjects' intention to adopt cloud computing.

### **Perceived Ease of Use of Cloud Computing (PEU)**

Perceived ease of use is defined as the degree to which the prospective user expects the target system to be free of effort (Davis et al., 1989). This factor was found to be significant in the individual adoption of cloud services on mobile devices by Park and Kim (2014). In a study among Chinese consumers,

Figure 1. Proposed research model



Wang (2016) reported that perceived ease of use was significant in the context of personal cloud storage adoption. Therefore, perceived ease of use may also be a predictor in the individual adoption of individual cloud computing in a more general cloud computing context. We thus hypothesize that:

**H2:** Perceived ease of use (PEU) positively affects subjects' perceived usefulness.

**H3:** Perceived ease of use (PEU) positively affects subjects' intention to adopt cloud computing.

### Perceived Usefulness of Cloud Computing (PU)

Davis et al (1989) has defined perceived usefulness as the prospective users' subjective probability that using a specific information system will increase their job performance within an organizational context. This factor has a significant impact on usage intention (Davis et al., 1989). Prior studies also reported that this construct positively influenced subjects' intention to adopt cloud computing (Arpaci, 2016; Changchit & Chuchuen, 2018; Park & Kim, 2014; Wang, 2016). Based on the foregoing, we propose the following hypothesis:

**H4:** Perceived usefulness (PU) positively affects subjects' intention to adopt cloud computing.

### Perceived Security of Cloud Computing (PS)

Since security is usually a major concern for all individuals who are dealing with sensitive data in everyday life, there is a high likelihood that subjects should be more willing to adopt cloud computing if they find this technology to be secure. Shin (2013) found that security does influence cloud computing adoption in government organizations. Thus, perceived security may also influence individual cloud computing adoption. We therefore posit that:

**H5:** Perceived security (PS) positively affects subjects' intention to adopt cloud computing.

### Perceived Speed of Access of Cloud Computing (PSA)

Access to computing resources over the Internet at a reasonable speed is of the utmost importance for cloud computing to be widely accepted (Changchit & Chuchuen, 2018). The speed of using

applications over the Internet can be a factor that has prevented cloud computing from being a viable option for some individual consumers. Users may be unaware that the use of applications via the Internet still allows them to retrieve the data at the same speed as when the data is stored locally. Subjects' perception on the speed of access should influence their intention to adopt cloud computing. Hence, we posit that:

**H6:** Perceived speed of access (PSA) positively affects subjects' intention to adopt cloud computing.

### **Perceived Cost of Usage of Cloud Computing (PCU)**

In 2011, the average cloud expenditure of a typical company was roughly \$6,500 per year. In 2020, this number has risen to \$10,000 per month (Ikink, 2021). Among the most common benefits recognized when changing to cloud computing is no or low cost (Das et al., 2013). The expense related to cloud computing for individual consumers is much lower and sometimes even free of charge. Thus, subjects' perception on the cost of cloud computing should impact their willingness to adopt this technology. We therefore hypothesize that:

**H7:** Perceived cost of usage (PCU) positively affects subjects' intention to adopt cloud computing.

### **Normative Beliefs (NB)**

Normative beliefs are a crucial factor that shapes the intention of individuals (Changchit et al., 2017). In this study, normative beliefs are defined as the assessment of how likely or unlikely an individual is to adopt cloud computing depending on the behavioral expectations of others important to them. This factor produces a perceived social pressure for individuals to engage or not engage in particular behaviors. Therefore, we hypothesize that:

**H8:** Normative beliefs (NB) positively affects subjects' intention to adopt cloud computing.

## **RESEARCH METHODOLOGY**

### **Development of Measurement Instrument**

The measurement scales for this study utilized the TAM survey instrument and modified it with the addition of five constructs. The perceived ease of use and perceived usefulness factor survey items were revised from the work of Venkatesh et al. (2003). Other survey items to measure the additional factors in this study were developed to identify the significant constructs leading to consumers' intention to adopt cloud computing. Several tests such as reliability, KMO and Bartlett's, common method bias, and factor analysis were conducted on this study's factors to verify and validate their suitability for the measurement model in this study. These results are described in the data analysis section of this paper.

The questionnaire consists of forty-seven (47) questions. Forty questions with a five-point Likert scale were designed to measure subjects' perceptions on cloud computing and their intention to adopt cloud computing. The remaining seven questions were asked to gather demographic data on the subjects. To validate the clarity of these questions, three professors and three researchers were asked to read through the survey questions. Revisions to the survey were made based on the feedback received.

### **Data Collection**

The surveys were administered to students at a university located in the Southern United States. For the data collection, a researcher contacted instructors from various courses to gain their consent to distribute paper copies of the surveys in their classes. In each class, a researcher spent about ten minutes

explaining the importance of the study and explained the objectives of this study. Paper-based copies were then distributed to the students who were willing to participate. Students were then asked to read each item carefully and record their responses on the paper-based survey as their responses are very important to this study. The students were provided with sufficient class time to respond to the survey. Students were informed that participation in the study was voluntary and that their responses would be kept anonymous. The students were also provided with the principal investigators contact information as well as the contact information of the Institutional Review Board should they have any questions about the study.

The use of students as subjects are appropriate for this type of study as students, as future professionals, are certainly part of the target group for companies providing cloud computing services. Prior research has suggested that students are acceptable surrogates for online technology as they tend to be younger and more educated than the general population (Bellman et al., 1999). Four hundred and sixty-seven (467) subjects participated in this study. However, only four hundred and thirty-five (435) responses were usable. Details on the subjects' demographics are provided in Table 1.

**Table 1. Subjects' demographics (n=435)**

	No.	%		No.	%
<b>Gender</b>			<b>Ethnicity</b>		
Male	170	39.1	African	5	1.2
Female	223	51.3	Anglo	54	12.4
No answer	42	9.6	Asian	17	3.9
			Hispanic	92	21.2
<b>Age</b>			Native American	3	0.7
18 - 24	347	79.7	Other	0	0.0
25 - 34	48	11.0	No Answer	264	60.6
35 - 44	9	2.1			
45 and over	6	1.4	<b>Classification</b>		
No answer	25	5.8	Freshman	77	17.7
			Sophomore	136	31.3
<b>First Generation College Student</b>			Junior	115	26.4
Yes	158	36.3	Senior	41	9.4
No	217	49.9	Graduate	23	5.3
No answer	60	13.8	Other	0	0.0
			No answer	43	9.9
<b>College</b>					
Business	217	49.9	<b>Employment Status</b>		
Education	34	7.8	Full-time	45	10.3
Liberal Art	56	12.9	Part-Time	196	45.1
Nursing	38	8.7	Un-employed	151	34.7
Science & Technology	43	9.9	No Answer	43	9.9
No answer	47	10.8			

## DATA ANALYSIS AND DISCUSSION

The statistical software package SPSS 26 with AMOS 25 was used to analyze the respondents' data. Hair et al. (2009) recommends that the sample size should be ten times the number of model variables. Therefore, our sample of 435 exceeds the recommended sample size. Table 2 summarizes the items measuring the attitude towards the intention to adopt cloud computing and seven factors proposed to influence subjects' intention. All items use a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

### Reliability Test

A reliability test was conducted to examine the internal consistency for each of the factors in the study. The Cronbach  $\alpha$  values are listed in the second column next to the factors listed in Table 2. All alpha values are greater than the recommended value of 0.70 (Nunnally, 1978). Thus, the reliability of the study factors is acceptable.

### KMO and Bartlett's Test

As shown in Table 3, the KMO and Bartlett's Test was conducted to assess the degree of unidimensionality of the scales. The test confirmed the sampling adequacy with the value of 0.954. The Bartlett's test of sphericity showed a p-value of 0.000 for both sets of data. Thus, the null hypothesis was rejected regarding no difference between the correlation matrix and the identity matrix.

### Multicollinearity Test

The variance inflation factor (VIF) is a common measure used to assess the multicollinearity between independent variables. Hair et al. (2009) recommends a VIF score below 5.0 to demonstrate that multicollinearity is not an issue among the independent variables. Table 4 lists the results of the multicollinearity test. The VIF scores range between 1.326 to 2.252 falling within the acceptable range for VIF scores.

### Construct Validity Test-Factor Analysis

Confirmatory factor analysis with varimax rotation was conducted to examine the construct validity and to verify the groupings of the survey items adopted from previous studies. The results of the factor analysis confirm that the forty survey items distributed themselves into eight factors (see Table 5). The survey items which recorded a value below the suggested reliability level of 0.5 (Hair et al. 2009) were removed from the data analysis.

### Discriminant Validity Test – Average Variance Extracted

As shown in Table 6, a correlation analysis was conducted to test the relationship between each variable. The correlation between the intention to adopt cloud computing (INT) and its determinants ranged from 0.387 to 0.645, indicating a high likelihood that these factors influence subjects' intention to adopt cloud computing. The construct validity was also assessed by testing the discriminant validity. The discriminant validity is the extent to which the items do not correlate with other items of a different construct (Roni 2014). In order to test the discriminant validity, the average variance extracted (AVE) for all constructs were calculated to ensure that they are  $> 0.5$ . The square root of AVE was also compared with the inter-construct correlations. The results in Table 6 demonstrate that the discriminant validity is supported as the square root of the constructs' AVE was greater than the correlations of the construct with all other constructs (Fornell & Larcker, 1981; Hulland, 1999; Roni, 2014).

### Common Method Bias

To ensure that the model is free from common method bias, which is a measurement error that threatens the validity of conclusions drawn from statistical results, Harman's single factor test was conducted.

**Table 2. Measure subscales, internal consistency, means (M), and standard deviation (SD)**

	<b><math>\alpha</math></b>	<b>M</b>	<b>SD</b>
Perceived Usefulness of Cloud Computing	0.877	3.68	0.79
Using cloud computing will better prepare me for professional work			
Using cloud computing will make me more competitive in the job market			
Using cloud computing will make me more efficient performing computer tasks			
Using cloud computing will make others more aware of my work			
Using cloud computing allows me to access my files 24x7 worldwide			
Perceived Ease of Use of Cloud Computing	0.892	3.40	0.82
It is easy to use applications via cloud computing			
It is easy to learn how to use applications via cloud computing			
It is easy to understand how cloud computing works			
It is easy to get help troubleshooting issues with the cloud computing			
It is easy to find vendors that offer cloud computing services			
Perceived Security of Cloud Computing	0.889	3.32	0.74
The company that provides the service will protect my data from the theft			
The company that provides the service prevent unauthorized access to my files			
The company that provides the service have the means to prevent the loss of my data			
The company that provides the service be a technology leader			
The company that provides the service encrypt my data			
Perceived Speed of Access of Cloud Computing	0.931	3.65	0.81
The speed of using cloud computing is pretty fast			
The speed of using cloud computing is sufficient for backup and storage			
The speed of using cloud computing to upload/download files is pretty fast			
The speed of using cloud computing to work on files is pretty fast			
The speed of using cloud computing is good enough for my everyday			
Perceived Cost of Usage of Cloud Computing	0.904	3.49	0.81
The cost of using cloud computing is inexpensive for the amount of storage provided			
The cost of using cloud computing is less expensive than buying storage for a laptop/PC			
The cost of using cloud computing is inexpensive compared to cost of using other types of storages			
The cost of using cloud computing is worth for the value of using it			
The cost of using cloud computing is inexpensive as there is no maintenance cost			
Normative Beliefs	0.826	3.10	0.80
People around me think that I should use cloud computing			
My family thinks that I should use cloud computing			
My friends influence my decision to use cloud computing			
Cloud computing is the technology that everyone should be familiar with			
Using cloud computing makes me feel current in the trend			

*continued on following page*

Table 2. Continued

	$\alpha$	M	SD
Technology Competency	0.936	3.96	0.95
I like to learn new technology			
I am not afraid of using technology			
My ability to learn new technology is high			
I am always interested in new technology			
I enjoy working with technology			
Intention to Adopt Cloud Computing	0.948	3.51	0.92
I will certainly use cloud computing service			
I intend to use cloud computing service			
I am willing to use cloud computing service			
I intend to use various cloud computing services			
I believe that I will like using cloud computing services			

Table 3. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.954
Bartlett's Test of Sphericity	Approx. Chi-Square	12212.259
	df	561
	Sig.	0.000

Table 4. Multicollinearity test

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-.522	.164		-3.182	.002		
PU	.213	.048	.187	4.427	.000	.522	1.916
PEU	.083	.047	.076	1.760	.079	.502	1.992
PS	.103	.043	.093	2.409	.016	.628	1.593
PSU	.212	.050	.189	4.211	.000	.462	2.166
PC	.193	.052	.168	3.669	.000	.444	2.252
NB	.139	.037	.133	3.773	.000	.754	1.326
TC	.201	.039	.206	5.162	.000	.586	1.705

a. Dependent Variable: INT

Table 5. Factor analysis

Constructs	Component							
	1	2	3	4	5	6	7	8
Perceive Usefulness (PU1)	.135	.271	.259	.208	.186	<b>.694</b>	.091	.151
Perceive Usefulness (PU2)	.138	.160	.166	.120	.072	<b>.804</b>	.145	.150
Perceive Usefulness (PU3)	.219	.264	.197	.229	.210	<b>.699</b>	.099	.030
Perceive Usefulness (PU4)	.198	.119	.178	.181	.208	<b>.696</b>	.050	.095
Perceived Ease of Use (PEU1)	.219	.190	.270	.200	<b>.718</b>	.218	.121	.081
Perceived Ease of Use (PEU2)	.274	.208	.191	.202	<b>.763</b>	.221	.130	-.004
Perceived Ease of Use (PEU3)	.227	.151	.224	.224	<b>.762</b>	.157	.099	.019
Perceived Ease of Use (PEU4)	.171	.191	.033	.121	<b>.706</b>	.100	.187	.256
Perceived Security (PS1)	.119	.154	.228	.197	.175	.085	<b>.793</b>	.103
Perceived Security (PS2)	.154	.179	.179	.159	.127	.088	<b>.848</b>	.113
Perceived Security (PS3)	.161	.176	.096	.272	.127	.152	<b>.766</b>	.086
Perceived Speed of Access (PSA1)	.180	<b>.757</b>	.199	.187	.141	.217	.114	.123
Perceived Speed of Access (PSA2)	.195	<b>.765</b>	.218	.281	.125	.204	.096	-.005
Perceived Speed of Access (PSA3)	.181	<b>.769</b>	.168	.158	.207	.104	.186	.115
Perceived Speed of Access (PSA4)	.214	<b>.769</b>	.192	.223	.182	.203	.183	.104
Perceived Speed of Access (PSA5)	.188	.695	.282	.254	.158	.165	.133	.149
Perceived Cost of Usage (PCU1)	.083	.156	.166	<b>.737</b>	.138	.148	.180	.074
Perceived Cost of Usage (PCU2)	.159	.187	.170	<b>.736</b>	.163	.182	.156	.103
Perceived Cost of Usage (PCU3)	.151	.276	.141	<b>.737</b>	.175	.169	.167	.147
Perceived Cost of Usage (PCU4)	.145	.266	.265	<b>.687</b>	.123	.183	.125	.186
Perceived Cost of Usage (PCU5)	.201	.186	.252	<b>.702</b>	.190	.109	.174	.183
Normative Beliefs (NB1)	-.013	.204	.180	.238	.120	.088	.003	<b>.743</b>
Normative Beliefs (NB2)	-.081	.028	.119	.188	.139	.085	.132	<b>.834</b>
Normative Beliefs (NB3)	-.035	.072	.095	.029	-.011	.121	.103	<b>.804</b>
Technology Competency (TC1)	<b>.823</b>	.206	.170	.104	.142	.145	.043	-.021
Technology Competency (TC2)	<b>.751</b>	.160	.120	.123	.183	.090	.175	-.104
Technology Competency (TC3)	<b>.837</b>	.169	.137	.152	.200	.105	.087	-.032
Technology Competency (TC4)	<b>.849</b>	.129	.215	.142	.119	.175	.089	-.003
Technology Competency (TC5)	<b>.836</b>	.129	.221	.107	.146	.148	.119	.036
Intention to Adopt (INT1)	.259	.262	<b>.747</b>	.205	.138	.215	.169	.152
Intention to Adopt (INT2)	.206	.224	<b>.766</b>	.227	.175	.218	.201	.162
Intention to Adopt (INT3)	.236	.305	<b>.733</b>	.191	.185	.200	.078	.052
Intention to Adopt (INT4)	.186	.178	<b>.748</b>	.223	.152	.191	.183	.207
Intention to Adopt (INT5)	.265	.187	<b>.752</b>	.247	.167	.169	.137	.119

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.  
The loadings of <0.5 were removed from the data analysis.

**Table 6. Correlation matrix and average variance extracted (AVE)**

Constructs	Average Variance Extracted (AVE)	Square Root of AVE	PU	PEOU	PS	PSA	PCU	NB	TC	INT
PU	0.5640	0.7510	1							
PEU	0.5442	0.7377	.568**	1						
PS	0.6449	0.8031	.421**	.477**	1					
PSA	0.5645	0.7513	.589**	.573**	.506**	1				
PCU	0.5186	0.7201	.573**	.574**	.550**	.639**	1			
NB	0.6313	0.7946	.337*	.298**	.306**	.324**	.414**	1		
TC	0.6723	0.8200	.480**	.540**	.394**	.510**	.449**	.055	1	
INT	0.5614	0.7493	.621**	.581**	.517**	.645**	.638**	.387**	.552**	1

\*\* Correlation is significant at the 0.01 level.

The Harman's single factor test which is the most widely used in the literature was conducted (Roni, 2014) and was obtained by running an un-rotated, single-factor constraint of factor analysis in SPSS statistics. The result shows the variance explained by a single factor of 41.498%, which is less than the recommended 50% cut-off point (Roni, 2014), indicating that the common method bias is not a major concern in this study.

### Structural Equation Model

SPSS AMOS 25 was utilized to evaluate the proposed research model. To test the overall goodness of fit of the proposed research model, the measures of df/Chi-square, Goodness of fit, Adjusted goodness of fit, Root mean square error of approximation, Comparative fit index, Tucker Lewis index, and Normed fit index were employed. Table 7 reveals that all the goodness of fit indices fall within their acceptable levels (Bentler & Bonett, 1980; Hu & Bentler, 1999; Tucker & Lewis, 1973). This reveals that the proposed research model exhibited a good fit with the data.

### Hypothesis Testing

Properties of the causal paths including standardized path coefficients are presented in Figure 2. The results of hypothesis testing are shown in Table 8.

For hypothesis H1, the results demonstrate a significant relationship between subjects' technology competency and their perceived ease of use of cloud computing ( $\beta = 1.008$ ,  $p\text{-value} < 0.001$ ). This

**Table 7. Fit indices for the models**

Fit Indices	Recommended Value	Measurement Model
Chi-square (CMIN)/df	$\leq 3.00$	1.282
Goodness-of-fit (GFI)	$\geq 0.90$	0.999
Adjusted goodness-of-fit (AGFI)	$\geq 0.80$	0.999
Normed fit index (NFI)	$\geq 0.90$	0.998
Tucker Lewis Index (TLI)	$\geq 0.90$	0.995
Comparative fit index (CFI)	$\geq 0.93$	0.999
Root Mean Square Error of Approximation (RMSEA)	$\leq 0.06$	0.025

Figure 2. Standardized path coefficients

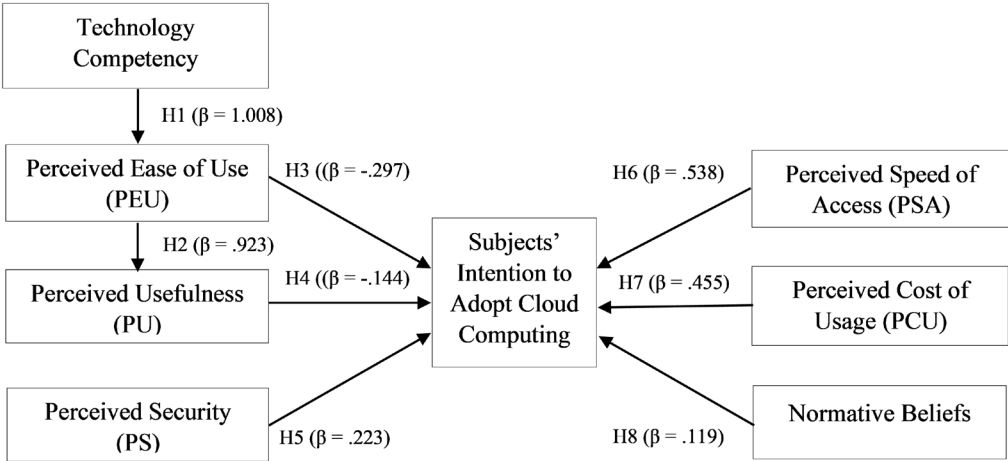


Table 8. Hypothesis testing and results

H#	Hypothesis Testing			Standardized estimate (β)	Critical Ratio	p-value
1	Technology Competency	→	Perceived Ease of Use of Cloud Computing	1.008	11.102	***
2	Perceived Ease of Use of Cloud Computing	→	Perceived Usefulness of Cloud Computing	0.923	14.371	***
3	Perceived Ease of Use of Cloud Computing	→	Intention to Adopt Cloud Computing	-0.297	-2.049	0.040
4	Perceived Usefulness of Cloud Computing	→	Intention to Adopt Cloud Computing	-0.144	-1.048	0.294
5	Perceived Security of Cloud Computing	→	Intention to Adopt Cloud Computing	0.223	3.651	***
6	Perceived Speed of Access of Cloud Computing	→	Intention to Adopt Cloud Computing	0.538	5.109	0.004
7	Perceived Cost of Usage of Cloud Computing	→	Intention to Adopt Cloud Computing	0.455	4.610	***
8	Normative Beliefs	→	Intention to Adopt Cloud Computing	0.119	2.726	0.006

\*\*\* indicates significance level < 0.001

finding indicates that subjects who consider themselves confident with using computers also find it easy to use cloud computing.

The results of hypothesis H2 confirms the relationship between perceived ease of use and perceived usefulness ( $\beta = 0.923$ ,  $p\text{-value} < 0.001$ ). The finding is in line with the study conducted by Davis et al. (1989), which indicates that the perceived ease of use can positively influence subjects' perceived usefulness.

Hypothesis H3 examines the relationship between perceived ease of use of cloud computing and subjects' intentions to adopt cloud computing. The results show partial support for H3 by revealing a

significant relationship between perceived ease of use and intention to adopt cloud computing ( $\beta = -0.297$ ,  $p\text{-value} = 0.040$ ) at the 5 percent level of significance. However, the relationship found was a negative relationship instead of the proposed positive relationship. This significant result confirms the findings of some prior studies (e.g., Koenig-Lewis et al. 2010; Liébana-Cabanillas et al. 2016), but contradicts to other studies (e.g., Dasgupta, et al. 2011; Sripalawat et al. 2011).

Regarding hypothesis H4, the results reveal that the factor perceived usefulness of cloud computing does not have a significant effect on subjects' intentions to adopt cloud computing ( $\beta = -0.144$ ,  $p\text{-value} = 0.294$ ). This finding contradicts earlier research by Hanafizadeh et al. (2014) but confirms the findings of research by Lucia-palacios, Pérez-lópez, & Polo-redondo, (2016). It appears that whether subjects believe that cloud computing is useful or not, it does not impact their intention to adopt cloud computing.

Hypothesis H5 reveals the relationship between perceived security of cloud computing and subjects' intention to adopt cloud computing ( $\beta = 0.223$ ,  $p\text{-value} < 0.001$ ). This result validates prior studies that perceived security plays an important role in technology acceptance (Alalwan et al., 2017; Bhatt, 2016; Svilar & Zupančič, 2016). It is apparent that subjects are willing to adopt cloud computing if they believe this technology is secure.

For hypothesis H6, the result confirms that there is a significant relationship between perceived speed of access of cloud computing and subjects' intention to adopt cloud computing ( $\beta = 0.538$ ,  $p\text{-value} = 0.004$ ). It is quite obvious that the speed of access should be considered a crucial feature of cloud computing. Subjects who view cloud computing as having a good speed of access are more likely to want to adopt cloud computing.

The results also demonstrate support for H7. The perceived cost of usage of cloud computing is positively related to subjects' intention to adopt cloud computing ( $\beta = 0.455$ ,  $p\text{-value} < 0.001$ ). This finding indicates that subjects who perceive the cost of the cloud computing as low are more willing to adopt cloud computing technology.

Lastly, hypothesis H8 reports a positive relationship between normative beliefs and subjects' intention to adopt cloud computing ( $\beta = 0.119$ ,  $p\text{-value} = 0.006$ ). This finding conforms to the result in a prior study conducted by Bock et al. (2005). Since subjects usually need to share data among friends and family members, they are more likely to be heavily influenced by the experiences of these people.

## STUDY IMPLICATIONS

This study contributes to the existing information systems theory on cloud computing by both proposing and empirically testing antecedents that contribute to individuals' intention to adopt cloud computing. The TAM was extended in this study to include the factors of normative beliefs, perceived cost of usage, perceived speed of access, perceived security, and technology competency. All the factors in the model except that of TAM's perceived usefulness were found to be statistically significant contributors to individuals' intention to adopt cloud computing.

This study also provides practical and scientific insights into the adoption of cloud computing by individuals. While there are some prior studies that focus on cloud computing adoption among individual users, many of the previous studies have focused on the adoption of cloud computing by organizations. Therefore, this study will contribute to the current literature by focusing on the underrepresented area of individual adoption of cloud computing.

One of the findings shows a significant relationship between normative beliefs and intention to adopt cloud computing. This shows the influence that a referent group has on the individual. Thus, if an organization is implementing a cloud computing solution, it is important to gain the buy-in of social influencers to attract acceptance by other individual users. This is important since users show more satisfaction towards systems that they perceive were voluntarily accepted instead of being forced to use.

Another finding showed that perceived usefulness did not seem to significantly influence the individual adoption of cloud computing. This could be due to the fact that various information technologies have been in use for many years. Thus, it could be assumed that most if not all information technology will be useful to some extent; so, it is no longer considered as a crucial factor.

The fact that the study only provided partial support for the perceived ease of use factor is also important. Various information technologies have been in use for decades and the younger members of the workforce are digital natives having grown up with technology. Thus, IS adoption may be at a point where perceived usefulness and perceived ease of use of a technology are assumed at this point. Future studies employing perceived usefulness and perceived ease of use may begin to increasingly find that those two factors are no longer significant in the adoption decision of a new technology.

These findings along with the other findings in this study could assist cloud computing service providers by providing them information on which benefits of cloud computing to focus on in their marketing to individual users. By touching on the factors that individuals perceive as important, cloud computing providers can better convince individuals to adopt their services.

## **CONCLUSION**

The results in this study reveal that six out of the seven factors play an important role in encouraging subjects' intention to adopt cloud computing either through an indirect or direct relationship and the results also show partial support for a fifth hypothesis. The results of the data analysis reveal support for hypotheses H1-H2 and H5-H8 (see Table 6). Hypotheses H3 was partially supported by showing significance; however, the relationship was found to be negative. The results show that hypothesis H4 was not supported. Overall, the independent variables in the research model are able to explain 77.918 percent of the variability in subjects' intention to adopt cloud computing.

The factors which significantly influence the adoption of cloud computing include technology competency, perceived ease of use (partial support), perceived security, perceived speed of access, perceived cost of usage, and normative beliefs. It is very interesting to find that the two original constructs in TAM do not fully impact subjects' intention to adopt the cloud computing technology as anticipated.

The results reveal that regardless of whether subjects perceive cloud computing as a technology that will be beneficial to them or whether they find this technology easy to use, it does not impact their decision to adopt this technology. In addition, the findings indicate that subjects with higher technological competency will find cloud computing easy to use than those who have lower technology competency and thus influence their intention to adopt this technology.

Findings in this study also demonstrate that the speed of access, perceived security, and the cost of using cloud storage are also crucial factors that can influence subjects' intention to adopt cloud computing. Consumers prefer technology that allows them to get what they want in a timely manner. The results also reveal that the likelihood that subjects will adopt cloud computing will be higher if they believe that the technology is secure. In addition, it does not matter how great a service a new technology can render, it will be useless if they cannot afford the cost of using it.

Based on the findings, normative beliefs also positively influence subjects' intentions to adopt cloud computing. This is quite understandable as cloud computing users will need to share data with their family members and friends. The attitudes of people around them should influence their intention to adopt the cloud computing technology.

As in most empirical studies, there is an inherent limitation in this research. The sample in this research was limited to subjects in one university. Although there was an attempt to gather the data from a variety of courses in the university, future research should be conducted at multiple universities. Prior research has suggested that students are acceptable surrogates for online technology as they tend to be younger and more educated than the general population (Bellman et al., 1999). The use of students in this type of research is common since students mostly have experience with using the

shared drive to work with other students. Nevertheless, the ability to generalize based on the results of this study may be limited since university students are not representative of all cloud computing users. Future studies could reduce this possible limitation by collecting sample data that may produce more generalizable results. Future research could also introduce culture into the model to identify specific differences between collectivist cultures and individualistic cultures as well as other cultural effects. In addition, future studies could investigate in more detail which feature of cloud computing will help in the decision to adopt cloud computing.

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