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Factors Influencing Users' Willingness to Use Cloud Computing Services: An Empirical Study

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Abstract. Cloud computing technology is one of the newest technologies widely used by consumers globally due to its advantages. One of the common advantages is that users can get access to applications and their own files and data on demand. However, there are privacy concerns which discourage users from being active in cloud computing. This paper attempts to investigate the factors that influence consumers' willingness to use cloud computing services by using a quantitative research approach. A total of 340 cases were gathered from a sampled population of students. Based on SPSS analysis, the study found that perceived privacy control, perceived effectiveness of privacy policy, and information privacy concerns in a cloud computing environment have significant influence on users' willingness to use cloud computing services.

Keywords: Willingness to Use Cloud Services, Privacy Concern, Cloud Computing, Privacy Policy, Privacy Control, Security, Cloud, Privacy Risk in Cloud.

1 Introduction

Cloud computing is a recent trend in the field of information and communication technology. It is defined by the US National Institute of Standards and Technology (NIST) as *"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"*. According to the Criminal Justice Information Services department (CJIS), this is the most accepted definition. Cloud computing deals with computation, software, data access and storage services that may not require end-user knowledge of the physical location and the configuration of the system that is delivering the services [1].

1.1 Background of Study

Cloud computing technology offers various types of services and applications for the public and organizations. One of the most commonly used cloud computing services

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is social networking such as Facebook, LinkedIn, Twitter, Instagram and many others, although these were not initially considered cloud computing services. Another example of cloud computing services is E-mail services. Other major example of cloud computing services is Google Drive. All of Google's services could be considered as cloud computing such as Gmail, Google Calendar, Google Reader, Google Voice, Google glass and so on. In addition, Apple's cloud service is primarily used for online storage and synchronization of user mail, contacts, calendar, and more. All the data you need is available to you on your iOS, Mac OS, or Windows device. Prior studies found that information privacy concerns is an essential factors that discourage and influence users from transiting through online channel [2]. Researchers found that the growth and success of a new technology and e-commerce is linked to users' willingness to disclose personal information to service providers [3] [4].

2 Research Model

2.1 Willingness to Use Cloud Computing Services

In this study, willingness to use cloud computing services is a dependent variable which has been addressed by allocating five items. Overall, almost all previous studies investigated willingness to disclose personal information in online banking and e-commerce whereas this study assesses it in the context of a cloud computing environment. According to Wu, Huang, Yen, & Popova (2012), the success or growth of e-commerce is linked inextricably to consumers' willingness to provide personal information to service providers [5]. Most researches have focused on privacy and risk generally as factors that influence users' intention to provide personal information to an online service provider [6]. Providing personal information to an online service provider has been studied in the domain of online shopping globally [7].

2.2 Information Privacy Concern

According to the Oxford Dictionary, privacy means *"The state or condition of being free from being observed or disturbed by other people"*. Mishra, Ranjita; Dash, Sanjit K (2011) indicated that privacy is the protection of transmitted data from passive attacks [8]. However, as cloud computing systems usually offer services (e.g. DaaS, SaaS, IPMaaS, PaaS, and so on) on the Internet, the secret information of individual users' is stored and managed by the service providers in the cloud, and consequently results in privacy concerns [9]. In this study, the researcher investigates the impact of users' information privacy concern on willingness to use cloud computing services. Previous studies found that there is negative relation between the privacy concern and willingness to disclose personal information. Therefore, hypotheses 1: Willingness to use cloud computing services is negatively affected by consumers' information privacy concerns [4] [10].

2.3 Perceived Privacy Control

Cloud computing technology involves distributed computation on multiple large-scale data sets across a large number of computer nodes. Every Internet user is able to share his or her personal data to the Cloud Computer systems which are located on the other side of the Internet. For instance, a user's click stream across a set of webs (e.g., Amazon book store, Google search web pages, etc.) can be used to provide targeted advertising [11]. However, few studies tried to clarify the nature of control in the privacy context. For instance, in privacy literature, control has been utilized to refer to several objectives such as social power and procedural fairness of an organization's privacy [12]. Studies have specified perceived privacy control based on three dimensions: 1) knowledge: users should be aware of a service provider's information practices. It is assumed that without this knowledge, a consumer is unable to make a decision as to either disclose personal information or not. 2) Choice/access: users should be provided with choices as to how their personal information is utilized beyond the use for which the information was provided. 3) Use of privacy tools: when privacy tools like protocol for privacy preferences (P3P) or privacy seals are used by some service providers then the user begins to believe that his control over his personal information is growing. Previous studies assumed that there is positive relationship between perceived privacy control and willingness to disclose personal information. Therefore, hypotheses 2: Perceived privacy control will positively influence consumers' willingness to use cloud computing services [4] [10].

2.4 Perceived Effectiveness of Privacy Policy

Privacy policies are notices that are displayed on an online service provider's website, accessible to the public, and describe an organization's information practices. Previous studies found that privacy policies and strategies that online service providers adopt and implement can have an impact on users' perception of online providers' fairness and trustworthiness and on users' willingness to engage in online transactions [13]. Meanwhile, other studies confirmed that the presence of a privacy policy had a significant influence on information disclosure in online shopping [13]. Generally, privacy policies should be designed to illustrate the steps that would employ to ensure obedience with the fair information principles. This is because the ultimate objective of any privacy policy is to provide consumers with comfort and security. Therefore, hypotheses 3: Perceived effectiveness of privacy policy will positively influence consumers' willingness to use cloud computing services.

2.5 Perceived Privacy Risk

Risk has been defined as the uncertainty resulting from the potential for a negative outcome and the possibility of another party's opportunistic behaviour that can result in losses for oneself. Therefore, usually negative perceptions are related to risk and it may influence an individual emotionally and physically [14]. Previous studies agreed that since online service providers required users' personal information as a part of

online transactions, users express their concern about such information being misused, sold, disclosed, or exchanged with other parties without authorization from the owners [15]. It has been proved that such risk perceptions of online users constitute an obstacle to the widespread acceptance of online transactions mainly when sensitive information is required [16]. There is thus a consensus among researchers that risk is vital factors in making any kind of online decisions. Thus, hypotheses 4: Perceived privacy risk will negatively influence consumers' willingness to use cloud computing services [15] [17].

2.6 Individuals' Factors

In this study, the researcher investigated whether the individuals' factors (age, gender, educational level) influence users' willingness to use cloud computing services. Nevertheless, prior studies assumed that the demographic factors influencing users' willingness to disclose personal information [4]. Therefore, hypotheses 5: There will be a significant relationship between the demographic information (age, gender, educational level) and willingness to use cloud computing services.

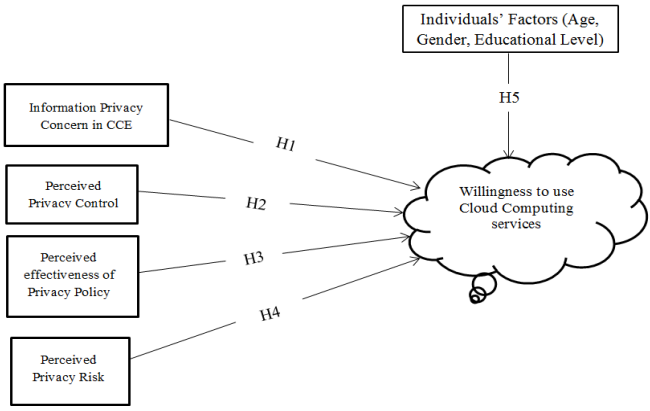

Fig. 1. Research Model

3 Methodology

A quantitative survey method has been adopted to collect data from targeted respondents. For that, we conducted a self-administered and online questionnaire to be answered by undergraduate and postgraduate students from the International Islamic University Malaysia as our sample with 340 cases as sample size. The survey items were adopted from prior studies where a five point-Likert scale was used for the items

4 Result

4.1 The Result of Demographic Information

The demographic profile of the respondents illustrates that the largest number of cases was from female students' 51.2.1% and 35.6% of the total respondents were aged in the group of below 20. Moreover, the majority of the respondents were undergraduate students (70.9%).

4.2 Reliability Test

Cronbach's alpha test was used out to measure the reliability of the items. It was agreed upon the lower limit which is 0.7 across all constructs. Table 1 illustrates that.

Table 1. Reliability result

Construct	Number of Items	Reliability
Privacy concern	4	.841
Perceived Privacy Control	4	.845
Perceived Effectiveness of Privacy Policy	3	.842
Willingness to Use Cloud Computing Services	5	.708

4.3 Cloud Computing Services Usage Rate

Based on previous studies, cloud computing services were categorized into five categories: Social Networking (e.g., Facebook, Twitter and others), Email Services (e.g., Hotmail, Gmail and others), Google Services (e.g., Google Drive, Google Apps, and others), Apple Services (e.g., iCloud, iTunes and others) and Data Storage Services (e.g., Box, Dropbox, and others). However, it can be seen that Social Networking services has the highest percentage of respondents with 29.93%, whereas apple services has the lowest percentage of respondents with 7%. Between the highest and the lowest percentage of respondents are categories that include Email services 26.70%, Google services 21.64% and Data storage services 14.73% respectively.

4.4 Testing Research Hypotheses

A multiple linear regression technique was used for testing the hypotheses. The result provides two tables ANOVA and Coefficients. ANOVA table indicates the model is significant ($p = .000 < 0.05$). Nevertheless, the coefficients table shows that that there is significant relationship between perceived privacy control, perceived effectiveness of privacy policy, and willingness to use cloud computing services (perceived privacy control $p = .000$, perceived effectiveness of privacy policy $p = .000, < 0.05$, information privacy concern $p = .017$). On the other hand, the result illustrates that there is no significant relationship between perceived privacy risk and willingness to use cloud

computing services ($p = .681, > 0.05$). Therefore, hypotheses 1, 2, and 3 are supported except hypotheses 4. Table 2 provides the result of multiple linear regression.

Table 2. Multiple linear regression result

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.371	4	8.343	21.907	.000[b]
	Residual	127.575	335	.381		
	Total	160.946	339			

a. Dependent Variable: Willingness_To_Use

b. Predictors: (Constant), Privacy_Control, Privacy_Concern, Privacy_Policy, Priavcy_Risk

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.410	.252		9.571	.000
	Privacy_Concern	-.123	.051	-.155	-2.404	.017
	Priavcy_Risk	.021	.052	.027	.412	.681
	Privacy_Policy	.233	.043	.296	5.444	.000
	Privacy_Control	.152	.043	.191	3.545	.000

a. Dependent Variable: Willingness_To_Use

4.5 Individuals' Factors

In this study, the relationship between the demographic information and willingness to use cloud computing services is examined. It is assumed that *"There will be a significant relationship between the demographic information (age, gender, educational level) and willingness to use cloud computing services"*. Nevertheless, in this research the age is categorized into four groups (Below 21, 22 to 25, 26 to 30 and 30 and above). Therefore, the ANOVA technique was conducted. The result shows that there is no significant differences among the means' of age groups ($p = .061 > 0.05$), as illustrated by Table 3.

Table 3. ANOVA result for age group

ANOVA

Willingness

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3.482	3	1.161	2.476	.061
Within Groups	157.464	336	.469		
Total	160.946	339			

Multiple Comparisons

Dependent Variable: Willingness

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.
Below 21	22 to 25	.06300	.08470	.879
	26 to 30	-.13182	.12052	.694
	30 and above	-.26061	.13444	.214
22 to 25	Below 21	-.06300	.08470	.879
	26 to 30	-.19481	.11812	.352
	30 and above	-.32360	.13229	.071
26 to 30	Below 21	.13182	.12052	.694
	22 to 25	.19481	.11812	.352
	30 and above	-.12879	.15765	.846
30 and above	Below 21	.26061	.13444	.214
	22 to 25	.32360	.13229	.071
	26 to 30	.12879	.15765	.846

The t- test technique was carried out to test the significant differences between the means across educational levels. The result illustrates that there is significant different in the means across the two groups ($p = .034 < 0.05$), as seen in Table 4. The result shows that the mean for the postgraduate group is higher than the undergraduate group (Postgraduate Mean = 3.3939, Undergraduate Mean = 3.2199).

Lastly, in this study gender has two groups (Male and Female). The t- test technique was utilized to determine the significant differences between the means across the two groups. Table 4 shows the result of the t-test, which illustrates that there is no significant different in the means across the two groups ($p = .265 > 0.05$).

Table 4. *T-test* result for educational level

Group Statistics

	Educational_Level	N	Mean	Std. Deviation	Std. Error Mean
Willingness_To_Use	Undergraduate	241	3.2199	.68015	.04381
	Postgraduate	99	3.3939	.69837	.07019

Table 4. *(continued)*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Willing-ness_To_Use	Equal variances assumed	.029	.865	-2.127	338	.034	-.17402	.08183
	Equal variances not assumed			-2.103	178.199	.037	-.17402	.08274

Lastly, the gender in this study the gender has two groups (Male and Female). Thus, t- test technique was utilized to determine the significant differences between the means across the two groups. Table 5 shows the result of t- test, the result illustrates that there is no significant different in the means across the two groups ($p = .265 > 0.05$).

Table 5. T-test result for gender

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Willingness	Male	166	3.3133	.70061	.05438
	Female	174	3.2299	.67731	.05135

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Willingness	Equal variances assumed	.355	.552	1.116	338	.265	.08337	.07473
	Equal variances not assumed			1.115	335.798	.266	.08337	.07479

5 Discussion

This study revealed that Social Networking services have the highest percentage of usage rate among the participants. The outcome supports prior studies [18]. This study identified that there is a statistically significant relationship among information privacy concerns in cloud computing environment, perceived effectiveness of privacy policy, perceived privacy control, and willingness to use cloud computing services. Meanwhile, perceived privacy risk is not statistically significant upon users' willingness to use cloud computing services. This is similar to prior studies [19]. Our finding indicates that users' willingness to use cloud computing services is positively and significantly influenced by perceived effectiveness of privacy policy. This result is similar with Mollick, Joseph Sudeep (2005) who found that customers' willingness to transact online will be higher when venders have policies that allow customers the ability to authorize or give informed consent to data collection than when venders do not have effective and clear policies [20]. As for the demographic information such as age and gender, it has no significant influence on users' willingness to use cloud computing services, whereas, educational level has a statistically significant influence.

6 Conclusion

In this study, the primary objective was to identify the factors that influence users' willingness to use cloud computing services. Prior studies focused on the factors that influence users' willingness in e-commerce and online banking environment, whereas, this study investigated it in a cloud computing environment. Our findings proved that information privacy concerns, perceived privacy control, and perceived effectiveness of privacy policy have a statistically significant relationship on users' willingness to use cloud computing services. Meanwhile, perceived privacy risk has no significant influence on willingness to use cloud computing services. It is recommended that the quality of cloud services should be improved. One of the most interesting findings of our study is that users are uninformed of the process of data collection processes that take place while using cloud services as well as the possible reuse of the data by the cloud service provider. Hence, cloud computing service providers should provide clear and effective privacy policies to their clients; otherwise, users are not willing to use cloud services.

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