Development and Validation of a Questionnaire to Measure the Acceptance of Cloud Computing in Public Sectors

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Abstract

The cloud computing is growing with a variety of facilities available as well as the benefits that users will enjoy. The use of cloud computing has also expanded to the public sector to provide a better service experience. The question arises when there is an imbalance in the use of the cloud-based applications provided. A study on cloud computing acceptance among the public sector needs to be conducted. This study aimed to evaluate the face and content validity of the new instrument for cloud computing acceptance among Malaysian public sectors. There are ten non-expect in the IT and non-IT field participated in face validity. They rated the instrument for the relevance of each item based on a dichotomous rating of favourable or unfavourable. The feedback and comments are taking into consideration. An expert panel of eight academicians is involved in evaluating the judgmental evidence of the instrument for content validity. Items with Content Validity Index (CVI) greater than 0.80 were included in the final instrument. The final instrument contained 74 items of 5-point Likert scale multiple-choice options, classified under three dimensions, namely (1) technological; (2) human; (3) Technology Readiness Index; and attitude and behaviour. The finding supports the face and content validity of this 74-item questionnaire, hence could be further researched on construct validity.

Keywords: Instrument development, Content validity, Cloud computing, Acceptance, Public sector, Questionnaire, Survey, Measure.

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1. Introduction

Cloud computing technology has become a new option for many organizations in deciding the need for their data storage space. Cloud computing is a 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]. Access to cloud computing at the individual level is relatively new, even though this technology is widely used in many organizations [2].

Acceptance to cloud computing is influenced by many factors such as benefits, ease of use, security, mobility, scalability, cost-saving, human readiness, organizational and top management support, speed of internet and accessibility and environment [3]. Several previous studies that applied the theory of acceptance of innovation as done by Raja Yusof [4] using the Unified Theory of Acceptance and

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Use of Technology (UTAUT) model showed a positive impact on the use of new technologies. Among the variables studied are performance expectancy, effort expectancy, facilitating conditions, and usability expectancy.

Similarly, a study by Zaied [5] that applied the theory of Technology Acceptance Model (TAM) and DeLone and McLean Model (D&M) IS Success also listed some variables that had a significant impact on the adoption of new technologies. Among them are information quality, user satisfaction, user involvement, and training. Thus, from the analysis of the previous studies, this study has listed variables that will be used in the study of cloud computing acceptance among the public sector in Malaysia.

1.1 Instrument validation

The validity of a research instrument is an essential process of analysis to consider as a good instrument [6]. Validity means "measure what is intended to be measured" [7]. Taherdoost [8] lists four main types of validity, namely face validity, content validity, construct validity, and criterion validity. However, the study only discusses the two most commonly used validities in the study, namely face validity and content validity.

As a tool to be used to measure cloud computing acceptance by the public sector in Malaysia, the extent of the reliability and validity of the instrument has important implications to the various stakeholders in the public sectors. Therefore, this study is aimed to examine the validity and reliability of the cloud computing acceptance administered in the Malaysian public sectors. Also, this study aims to explore a further statistical analysis invalidating the instruments.

1.2 Background of the study

The instrument employed by this study was adapted from several previous studies that focused on the study of the adoption and use of cloud computing in the public sector. The questionnaire items to explore factors that influence public sector employees in Malaysia who use cloud-based computing applications in their formal affairs. The validity of the instrument is a strength of a research study design. Where it is strongly dependent on how precisely the identified variables are measured [6].

Validity ensures that the questions being asked allow valid inferences to be made. As previously stated, validity is of four main types, but this study addressed two of the most common and frequently used validities, namely face and content validity. The main focus of this paper is to develop a tool for measuring public sector acceptance of cloud computing. In particular, the research objectives are as follows: (1) to design and develop instrument; and (2) to validate an instrument to assess the acceptance of cloud computing.

2. Methodology

For the development and content validity of the new instrument, this study used the approach described by [9]. The first step is instrument design and construction (development). Items were generated from past research analysis, related reports,

and preliminary studies. The selection of variables in the past analysis will be based on the theory of selected studies such as TAM, TAM2, Diffusion of Innovations (DOI), and UTAUT.

The second step is translation. Translation into local languages is one of the ways to help research participants provide accurate answers. The third step is the validity of the instrument. The two main processes involved in this process are face validity and content validity. Face validity evaluates the appearance of the questionnaire in terms of feasibility, readability, consistency of style and formatting, and the clarity of the language used [8]. While content validity involves the evaluation of a new survey instrument in order to ensure that it includes all the items that are essential and eliminates undesirable items to a particular construct domain [10].

2.1 Development of the questionnaire

The questionnaire consisted of three main sections; *A-Profile Respondent*, *B-Information on Cloud Computing Services Usage*, and *C-Acceptance on Cloud Computing*. Based on preliminary studies in the design and construction of this study model, a total of 16 constructs were consolidated into one proposed model [11].

The 16 constructs are assorted into three main dimensions, namely, technological, human, and technology readiness index (TRI). Technological dimension comprises performance expectancy, effort expectancy, compatibility, security, trust, and mobility. The other four constructs, namely IT knowledge, top management support, social influence, and awareness, are grouped under the human dimension. The four core constructs in TRI are optimism, innovativeness, discomfort, and insecurity. The other two constructs, namely behavioural intention, and use behaviour are to measure the tendency and actual use of technology by users. Table 1 shows the items used to measure each construct used in this study.

The initial questionnaire contained 86 items of measurement. This research applied the Likert Scale format to measure the items in the survey instrument. A five-point Likert scale "1 = strongly disagree, 2 = disagree, 3 = not sure, 4 = agree, 5 = strongly agree" was used for all measurement items, which is same as to the originally adapted measurements. The items of measurement are adapted from the various previous study, as shown in Table 1.

Table 1. Measurement items for each construct

Construct	Code	Item	Source
Performance Expectancy	PER-1	I find cloud computing useful in my job.	[12]
	PER-2	Using cloud computing enables me to accomplish tasks more quickly.	[12]
	PER-3	Using cloud computing increases my productivity.	[12]
	PER-4	If I am using cloud computing, I will increase the opportunity to improve my work performance.	[12]
Effort Expectancy	EFF-1	My interaction with cloud computing would be clear and understandable.	[12]
	EFF-2	It would be easy for me to become skilful at using cloud computing.	[12]
	EFF-3	I would find cloud computing easy to use.	[13]
	EFF-4	Learning to operate cloud computing is easy for me.	[12]
	EFF-5	It would be easy for me to understand the various applications of cloud computing.	-

Compatibility	COM-1	Cloud computing is compatible with all aspects of IT services in my workplace.	[1]
	COM-2	Cloud computing is easy to integrate with existing IT infrastructure.	[14]
	COM-3	Cloud computing is compatible with other systems I use.	[14]
	COM-4	Cloud computing fits well with the scope of work and services I provide.	[14]
	COM-5	Cloud computing is compatible with the values and goals of my work.	[15]
	COM-6	Cloud computing is compatible with my organization operations and strategies.	-
Security	SEC-1	Cloud computing servers and data centres are secure.	[14]
	SEC-2	The information exchanged between organizations is under a secured communication network.	[16]
	SEC-3	Cloud computing have sufficient security controls.	[17]
	SEC-4	Data in cloud computing is protected against unauthorized changes.	[16]
	SEC-5	Cloud computing is continuously available base on users' credential.	[18]
	SEC-6	The probability of cloud computing services breakdown and disruption is low.	[19]
	SEC-7	Cloud providers maintain the privacy and confidentiality of organization data.	[14]
Trust	TRU-1	I believe that cloud computing is trustworthy.	[13]
	TRU-2	I believe that cloud computing is stable.	[20]
	TRU-3	I believe that cloud computing providers will protect users' rights.	[21]
	TRU-4	I believe that cloud computing is capable of overcoming all kinds of technical difficulties.	[21]
	TRU-5	I believe that certain technical procedures exist to protect personal and governmental information.	[21]
	TRU-6	I believe that cloud computing is capable of overcoming all kinds of technical difficulties.	[21]
	TRU-7	I feel comfortable using cloud computing services.	[22]
Mobility	MOB-1	I expect that I would be able to use cloud computing anytime and anywhere.	[23]
	MOB-2	I expect that cloud computing would be easily accessible and portable.	[23]
	MOB-3	I expect that cloud computing would be available for use whenever I need it.	[23]
	MOB-4	I expect that cloud computing will allow me to complete my job outside my office.	-
	MOB-5	In general, I expect that I would have control over my use of cloud computing anytime.	[23]
IT Knowledge	ITK-1	I have good knowledge of cloud computing.	[14]
	ITK-2	I have good knowledge about the underlying structure of cloud computing.	[14]
	ITK-3	I have good knowledge of the benefits of using cloud computing.	[14]
	ITK-4	I closely follow trends in cloud computing technology.	[1]
	ITK-5	I usually read the information on cloud computing services.	[21]
	ITK-6	In overall, I am are knowledgeable about cloud computing technology.	[24]
Top Management Support	TOP-1	My top management is highly interested in using cloud computing.	[25]
	TOP-2	My top management encourages the use of cloud computing.	[26]

	TOP-3	My top management is likely to invest funds in cloud computing.	[27]
	TOP-4	My top management is aware of the benefits of cloud computing.	[25]
	TOP-5	My top management is willing to take risks involved in the adoption of cloud computing.	[27]
	TOP-6	My top management has the vision to project our organization as a leader in the use of cloud computing.	[25]
Social Influence	SOC-1	People who influence my behaviour think that I should use cloud computing.	[12]
	SOC-2	People who are important to me think that I should use cloud computing.	[12]
	SOC-3	The management is helpful in the use of cloud computing.	[12]
	SOC-4	People around me is helpful in the use of cloud computing.	[12]
	SOC-5	In general, communities in my organization support the use of cloud computing.	[12]
Awareness	AWA-1	I am aware of the government cloud computing services provided to me.	[28]
	AWA-2	I know the benefits of using cloud computing services.	[28]
	AWA-3	I have gone through training programs related to cloud computing services.	[28]
	AWA-4	I have come across government campaigns/advertisements related to using cloud computing services.	[28]
	AWA-5	I know that the government is fulfilling its responsibility to make people aware and to educate them on cloud computing services.	[29]
	AWA-6	I know that the government is providing training to people to make the best use of cloud computing services.	[29]
Optimism[a]	OPT-1	Cloud computing contributes to a better quality of work.	[30]
	OPT-2	Cloud computing gives people more control over their daily work.	[30]
	OPT-3	Cloud computing gives me more freedom of mobility.	[30]
	OPT-4	Cloud computing makes me more productive in my work.	[30]
	OPT-5	Cloud computing is much more convenient to use.	[31]
	OPT-6	I prefer to use cloud computing technology in my work.	[31]
Innovativeness[a]	INN-1	Other people come to me for advice on cloud computing services.	[30]
	INN-2	I am among the first in my circle of friends to use cloud computing services when it was implemented.	[30]
	INN-3	I can usually figure out new features of cloud computing services without the help from others.	[30]
	INN-4	I keep up with the latest technological on cloud computing in my areas of interest.	[30]
	INN-5	I find that I have fewer problems compared to other people in using cloud computing services.	[31]
Discomfort[a]	DIS-1	When I get technical support from a service provider, I sometimes feel as if I am being taken advantage of by someone who knows more than I do.	[30]
	DIS-2	Technical support team is not helpful because they do not explain things in terms I understand.	[30]
	DIS-3	Sometimes, I think that cloud computing is not designed for ordinary people use.	[30]

[a] These questions comprise the Technology Readiness Index 2.0 which is copyrighted by A. Parasuraman and Rockbridge Associates, Inc., 2014. This scale may be duplicated only with written permission from the authors.

	DIS-4	I'm embarrassed when people around me know I'm having trouble with cloud computing applications.	[32]
	DIS-5	There is no such thing as a manual for a cloud computing service written in plain language.	[30]
Insecurity[a]	INS-1	I think people are too dependent on cloud-based application to do work.	[30]
	INS-2	I think the dependency on cloud computing would be harmful.	[30]
	INS-3	I think the widespread use of technology in work will reduce the quality of human relationships.	[30]
	INS-4	I feel not confident doing my job that can only be reached online.	[30]
	INS-5	I feel unsafe to store and share information online.	[32]
	INS-6	If I provide information to cloud computing, I can never be sure if it really gets to the right place.	[32]
Behavioural Intention	BEH-1	I intend to continue using cloud computing technology in the future.	[12]
	BEH-2	I will always try to use cloud computing technology in my daily works.	[13]
	BEH-3	I expect that I would use cloud computing in the future.	[12]
	BEH-4	I plan to continue to use cloud technology frequently.	[12]
Use Behavior	USE-1	I use cloud computing application on daily basis.	[33]
	USE-2	I use cloud computing application frequently.	[33]
	USE-3	I visit cloud computing application portal often.	[33]

2.2 Translate of the questionnaire

The survey was translated from English to Bahasa Malaysia to facilitate respondents' understanding of the questionnaire. This study uses the method proposed by [34], which is a one-way or expert translation. Therefore, this study has been using professional and certified translator services from the Malaysian Institute of Translation & Books *(Institut Terjemahan dan Buku Malaysia)*.

2.3 Face validity of the questionnaire

Face validity is the degree to which a measure appears to be related to a specific construct, in the judgment of non-experts such as test-takers and representatives of the legal system [8]. In order to examine the face validity, the dichotomous scale can be used with the categorical option of "Yes" and "No", which indicate a favourable and unfavourable item, respectively. According to Masuwai [6], the procedural suggest evaluated by two (or more) independent judges. Therefore, in the study of 10 respondents were invited and performed face validity procedures. The participants comprise IT, and non-IT users, public sector agency IT officers, academicians, and university students.

2.4 Expert content validity of the questionnaire

Expert judgment aims to ensure the measurement items correctly represent the construct, and each item measures what it is intended to measure. In this study, the content validity test suggested by McKenzie [35] will be performed by the expert to validate the instrument to be used. A Study by Kennedy [36] proposed a panel of five to ten experts is considered sufficient to evaluate the items of measurement.

Therefore, in this study eight experts were chosen for the content validity test based on their knowledge and education background, interest area, experience, and skill related to cloud computing adoption IS modelling, survey instrument development, and statistical analysis.

The experts were asked to evaluate the relevancy and clarity of each item by providing their rating for each item based on three scales: 1=Not relevance/not clear, 2=Relevant/clear but need some revision, 3=Very relevant/clear [37], [38]. Besides, the experts are also asked to provide any comments or feedback on any construct measurement.

Quantitative analysis includes Content Validity Ratio (CVR) and Content Validity Index (CVI) calculation to measure the validity of the survey items [8]. CVR is an item's statistic indicating the usefulness of item measurement to be accepted or rejected. CVR and CVI offer practicality in terms of time and cost, and also, it is quick and easy to perform [39]. Besides, CVI flexible as requires on a minimum of three experts. Using Lawshe [38], CVR was calculated for each measurement item by the CVR calculation, which is defined as follow:

$$CVR = \frac{(Ne - \frac{N}{2})}{\frac{N}{2}}$$

The value Ne is the number of experts indicating "relevant" (score of 2 and 3), and the value N is the total number of experts. Based on the total number of experts, which is eight, minimum CVR of 0.75 is required to accept the measurement item to be retained in the survey [38].

4. Results

Through two validity sessions conducted, face validity and content validity, several improvements to the questionnaire were made based on the results and recommendations.

4.1 Face validity

In general, participants feel that they do not have a big problem in understanding the requirements of the questions, and it is answerable. However, some points are raised for attention, and corrective action is as shown in Table 2.

Table 2. Summary of participants' feedback and decisions made in response

No	Comments	Decisions made on the comments
1	Some organizations use the name "Unit".	"Unit" is included in A1.
2	The use of the cloud in government applications is unclear.	Definitions have been provided on the front page. The words "refer to the front" were added to the respondent's reference.
3	Some departments use this service during the trial period before it launches.	"Before 2016" is included in B7.
4	Add "choose more if applicable."	Included in B5.
5	Not clear because it is not technically involved.	Revised according to the expert evaluation.
6	Need to do correction in sentence structure	Revised accordingly.

7	Improve the language used for the respondent.	Revised accordingly.
8	Reduce the number of items.	Revised according to the expert evaluation.
9	Double-barrel questions.	It is revised according to the expert evaluation.

4.2 Expert content validity

Expert evaluations show that all constructs are accepted as part of this research model. However, some items were dropped as a result of the calculation performed using the CVR method. Table 3 illustrates the CVR values for each item, the CVI value for each construct and overall survey validity, indicating that the validity of the survey instrument was achieved at 90% of CVI. While Table 4 highlights the summary of the comments and feedback by the experts and several decisions made accordingly.

Table 3. CVR and CVI of the survey instrument

Construct	Item	CVR	Decision	CVI	Construct	Item	CVR	Decision	CVI
Performance Expectancy	PER-1	1.00	Accept	1.00	Social Influence	SOC-1	0.75	Accept	0.80
	PER-2	1.00	Accept			SOC-2	0.75	Accept	
	PER-3	1.00	Accept			SOC-3	0.50	Drop	
	PER-4	1.00	Accept			SOC-4	0.75	Accept	
Effort Expectancy	EFF-1	1.00	Accept	0.80		SOC-5	0.75	Accept	
	EFF-2	1.00	Accept		Awareness	AWA-1	0.75	Accept	0.67
	EFF-3	1.00	Accept			AWA-2	0.50	Drop	
	EFF-4	1.00	Accept			AWA-3	1.00	Accept	
	EFF-5	0.50	Drop			AWA-4	1.00	Accept	
Compatibility	COM-1	1.00	Accept	0.83		AWA-5	0.50	Drop	
	COM-2	1.00	Accept			AWA-6	1.00	Accept	
	COM-3	1.00	Accept		Optimism	OPT-1	1.00	Accept	0.83
	COM-4	1.00	Accept			OPT-2	1.00	Accept	
	COM-5	1.00	Accept			OPT-3	0.50	Drop	
	COM-6	0.50	Drop			OPT-4	1.00	Accept	
Security	SEC-1	1.00	Accept	0.86		OPT-5	1.00	Accept	
	SEC-2	1.00	Accept			OPT-6	1.00	Accept	
	SEC-3	1.00	Accept		Innovativeness	INN-1	1.00	Accept	1.00
	SEC-4	1.00	Accept			INN-2	1.00	Accept	
	SEC-5	1.00	Accept			INN-3	1.00	Accept	
	SEC-6	0.75	Accept			INN-4	1.00	Accept	
	SEC-7	0.50	Drop			INN-5	1.00	Accept	
Trust	TRU-1	1.00	Accept	0.57	Discomfort	DIS-1	1.00	Accept	1.00
	TRU-2	1.00	Accept			DIS-2	1.00	Accept	
	TRU-3	0.50	Drop			DIS-3	1.00	Accept	
	TRU-4	0.50	Drop			DIS-4	1.00	Accept	
	TRU-5	1.00	Accept			DIS-5	1.00	Accept	
	TRU-6	0.75	Accept		Insecurity	INS-1	1.00	Accept	0.83
	TRU-7	0.50	Drop			INS-2	1.00	Accept	
Mobility	MOB-1	0.75	Accept	1.00		INS-3	1.00	Accept	
	MOB-2	0.75	Accept			INS-4	1.00	Accept	
	MOB-3	0.75	Accept			INS-5	1.00	Accept	
	MOB-4	0.75	Accept			INS-6	0.50	Drop	
	MOB-5	0.75	Accept		Behavioural Intention	BEH-1	1.00	Accept	1.00
IT Knowledge	ITK-1	1.00	Accept	0.83		BEH-2	1.00	Accept	
	ITK-2	0.50	Drop			BEH-3	1.00	Accept	
	ITK-3	1.00	Accept			BEH-4	1.00	Accept	
	ITK-4	1.00	Accept		Use Behavior	USE-1	1.00	Accept	1.00
	ITK-5	1.00	Accept			USE-2	1.00	Accept	
	ITK-6	1.00	Accept			USE-3	1.00	Accept	

Top	TOP-1	1.00	Accept	1.00
Management	TOP-2	1.00	Accept	
Support	TOP-3	1.00	Accept	
	TOP-4	1.00	Accept	
	TOP-5	0.75	Accept	
	TOP-6	0.75	Accept	

Overall CVI	**0.90**

Table 4. Summary of expert feedback and decisions made in response

No	Reviewer feedback	Decisions made on the comments
1	Improve language.	Revised accordingly.
2	Improve the sentence structure to be more consistent.	Revised accordingly.
3	Choose the correct measure input type (nominal, scale or ordinal).	Revised accordingly.
4	Split the double-barrel questions.	Revised accordingly.
5	Remove the repeat/duplicate/overlap questions.	Remove the duplicate/overlap questions.
6	Choose the suitable items only.	Revised accordingly.
7	Use the "MyGovUC cloud-based services" instead of "CC".	Use the suggested term in related items.

5. Discussion

This study established the face and content validity of questionnaires designed to assess the acceptance of cloud computing for Malaysian public sectors. The face validity shows some weaknesses that need to be addressed in the survey. Among the emphasis are the sentence structure and the language that the respondent can easily understand. The feedback received is considered appropriate.

The CVI used in this study indicates the validity of the survey instrument was achieved at 90% (74 out of 86 items were judged content valid by the content experts). The CVI value exceeded the expected minimum CVI of 0.80 [39] and thus showed an adequate content valid instrument. All the comments and corrections suggested by the experts been considered for revision. Finally, at the end of the face and content validity process, study instrument was prepared with 16 constructs and 74 items.

6. Conclusion

This new instrument has been found to demonstrate an adequate and acceptable measurement performance needed for a future descriptive study to assess the acceptance of cloud computing for the Malaysian public sector. This survey appeared to have adequate face and content validity and can be further arranged for the next steps and doing the rest of the actual data collection and analysis.

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