The Awareness and Challenges of Cloud Computing Adoption on Tertiary Education in Malaysia

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Abstract: This preliminary study aims to investigate the awareness of the adoption of cloud computing among the academicians in tertiary education in Malaysia. Besides, this study also want to explore the possible challenges faced by the academician while adopting this new technology. The pilot study was done on 40 lecturers in Universiti Teknologi MARA Kampus Kota Bharu (UiTMKB) by using self administered questionnaire. The results found that almost half (40 percent) were not aware on the existing of cloud computing in teaching and learning (T&L) process. The challenges confronting the adoption of cloud computing are data insecurity, unsolicited advertisement, lock-in, reluctance to eliminate staff positions, privacy concerns, reliability challenge, regulatory compliance concerns/user control and institutional culture/resistance to change in technology. This possible challenges can be factorized in two major factors which were security and dependency factor and user control and mentality factor.

Keywords: cloud computing, awareness, challenges, factor analysis.

1. Introduction

Computer technology has become an essential tool for educators to ensure that teaching and learning (T&L) process becomes more interesting and effective. The using of cloud computing will enhance T&L process which is differ to traditional techniques. Cloud computing is the interactive way for educators to collaborate with students along T&L process. Nowadays, social writing platforms appear to be logistically useful tools for a variety of campus needs, from student group learning to faculty department work to staff collaborations. By using computer technology in the classroom, will allow educators to explore new and exciting methods of instruction and learning beyond lecturing. There are a lot of useful and interactive website that can enhance classroom lessons.

A study conducted by [1] showed a comprehensive comparison between e learning system before and after moving onto Cloud to see the contribution of e learning standards with the Cloud standards. The result support the moving of e learning on to Cloud Computing environment where Cloud Computing is used as e learning solutions to delivery of computing as a service rather than a product.
The impact of cloud computing is that the adoption of cloud computing has a significant impact on cost effectiveness where it can reduce development team cost, technical support team cost, burden of daily backup management and cost of overall project expenditure [1, 2, 6, 3]. Furthermore, the adoption of cloud computing revealed that it will enhanced availability, low environmental impact, reduced IT complexities, mobility, scalability, increased operability and reduced investment in physical asset [2]. [7] analyzed three different perspectives of scheduling algorithms for energy efficiency which is heuristic, game theory and learning process strategy. As a result, they found out that heuristic strategy is a common method for scheduling tasks while managing the energy consumed. Energy management structure for cloud computing in order to develop the optimal energy efficient scheduling are identified through similarities, differences and energy models. They believed that the solution to green cloud computing is between energy consumption and system performance.

Comprehensive literature review on the cloud computing research had been conducted by [4] for 236 scholarly journals articles between 2009 and 2014. The main purpose of this study is to investigate the awareness and challenges of cloud computing adoption among the academicians in tertiary education in Malaysia.

2. Cloud Computing
Cloud computing allowed users to have access to data, applications and services anywhere. It also allows users to use application without installation of personal files. Nowadays, industries and educational areas are adopting the services of cloud computing because of the following reasons:

- **Low Cost** - with the cloud, the users will pay for applications only when needed and many applications are included free of charge.
- **Scalability.**
- **Ease of access** - Quite simply, cloud computing is easy to get up and running. Instead of having to download and/or install software yourself, in the cloud it is all done for you.
- **No time boundation** - This allows for on demand analysis of study material instantly.
- **High performance** - For using the cloud computing the performance should be enhanced. Cloud computing implies a level of dynamic, flexible resources, sharing and allocation of assets.
- **Cloud computing has four key concepts which are, service oriented architecture/thin clients, delivery models for cloud computing, virtualization and deployment strategies.**

Model of cloud computing are as follows:

- **Infrastructure as a Service (IaaS)** - focused on hardware and IT infrastructure management which includes storage and processing capabilities.
- **Platform as a Service (PaaS)** - Concentrates on middleware which provides development tools and hosting options for cloud clients to manage their own applications. PaaS gives end users control over application design, but not control over physical infrastructure.
- **Software as a Service (SaaS)** - includes software applications which support business related process like customer relationship management, supply chain management or enterprise resource planning. SaaS does not give end users control over application designs.
The illustration of the model of Cloud Computing is presented in Figure 1 [5].

![Cloud Computing Layers](image)

**Figure 1.** Illustration of the Layers for the Services Oriented Architecture.

3. **Materials and Methods**
The pilot study was conducted among UiTMKBs lecturers, from January to March, 2017. A validated administered questionnaire was used in this study. The questionnaire was adapted from [2]. The questionnaire consisted of three sections which were demographics profiles, awareness and challenges section. A total of 40 lecturers completed the questionnaire.

The reliability of questionnaire was tested by using the reliability analysis (Cronbach alpha). The Cronbach alpha for section challenges was 0.763 which indicated the instrument was reliable for data collection.

4. **Statistical Analysis**
Prevalence was calculated for awareness of the adoption of cloud computing among lecturers in UiTMKB. Factor analysis used to describe covariance relationship among challenges item in term of a few underlying but unobservable factors. A two sided hypothesis was used in analysis with \( p \leq 0.05 \) was considered statistically significant. All the data were analyzed using IBM SPSS version 20.

5. **Results**
There was 24 lecturers were aware on the adoption of cloud computing in T&L process (prevalence =60%), whereas 15 were female and the rest were male. Those who adopt IAAS, SAAS and PAAS were 20%, 55% and 10% respectively.

![Cloud Computing Awareness](image)

**Figure 2.** Cloud Computing Awareness
Initially the factorability of the eight items in section challenge was examined. Several well recognized criteria for the factorability of the correlation were used. Firstly, all of eight items correlated since all of the correlation values >0.3, suggesting reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .505, above the recommended value of .5, and Bartlett’s test of sphericity was significant ($\chi^2 (28) = 87.900, p < .05$). Finally, the communalities were all above .3 (see Table 1), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted with all 8 items.

Principle components analysis was used because the primary purpose was to identify and compute composite coping scores for the factors underlying the challenges. The initial eigen values showed that the first factor explained 38.6% of the variance and the second factor 30.4% of the variance. The remaining six factors explained 31.0% of the variance. The factor solutions were examined, using varimax rotations of the factor loading matrix. The two factor solution, which explained 69.0% of the variance, was preferred because of its previous theoretical support, the ‘leveling off’ of eigen values on the scree plot after two factors (see Figure 3), and the insufficient number of primary loadings and difficulty of interpreting the subsequent factors.

Out of eight challenges items, based on the rotated component matrix (see Table 1), these possible challenges can be factorized into two groups. The items in first factor were Data insecurity, Unsolicited Advertisement, Reluctance to eliminate staff positions, Privacy concerns, and Reliability challenge. While the items belong to second factor was Lock-in, Regulatory compliance concerns/ User control and Institutional culture/resistance to change in technology.

![Figure 3. Component Number](image-url)
Table 1. Extraction Method (Principal Component Analysis)

|                        | Communalities | Rotated Component |
|------------------------|---------------|-------------------|
|                        | Initial       | Extraction 1      | 2               |
| Data insecurity        | 1             | 0.764             | 0.665           | -0.566 |
| Unsolicited Advertisement | 1           | 0.679             | 0.814           | 0.127  |
| Lock-in                | 1             | 0.545             | -0.001          | 0.738  |
| Reluctance to eliminate staff positions | 1 | 0.391             | 0.592           | -0.202 |
| Privacy concerns       | 1             | 0.903             | 0.886           | 0.343  |
| Reliability challenge  | 1             | 0.786             | 0.811           | 0.358  |
| Regulatory compliance concerns/User control | 1 | 0.722             | 0.434           | 0.73   |
| Institutional culture/resistance to change in technology | 1 | 0.73             | 0.048           | 0.853  |

6. Other recommendations
The prevalence of awareness of the adoption of cloud computing among lecturers in UiTMKB was 60%, which was considered higher than the previous study done among public universities [2]. Based on the finding, most of the academicians in UiTMKB were comfort with SAAS in adopting cloud computing in their T&L process. This study also suggests that the challenges faced by academician while adopting this technology can be separated into two major themes. First, the challenges can be named as security and dependency factor which consisted five items and the rest items was named as user control and mentality factor.

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