The Policy as Repudiation Factors of Adopting Cloud Computing in University Administration

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**Abstract** — Cloud computing (CC) technology can be described as the next generation of Information technology for companies, educational institutions and governmental agencies; which provides easy and affordable access to state of the art technology; IT, technological application and services. Due to the growing needs for information technology (IT) and the current dwindling global financial stability, many higher education institutes including universities, are facing problems in providing the essentials of IT supports for administrative, educational, and research activities. However, CC is rarely implemented in universities in Malaysia. This research thus aims to find out the causal factor for the poor implementation and usage of CC in Malaysia universities. To achieve our aim, CC published works was reviewed to identify the staff positions as well as their required services. The outcomes of the review were applied to find out the models, services, and applications that are available in educational environments. Afterwards, an explorative case study was used to explore the factors that have caused the negligence of CC applications at universities. A semi-structured interview was used to collect data and samples were randomly chosen among administrators, IT staffs, technicians and clerks at one of the biggest public university in Malaysia. The data were analyzed both quantitatively and qualitatively. The findings showed that policy is the main reason to reject of using CC in administrative activities. Thus, with amendment of the existing policy, authorities can benefit from CC and as well as prevent the risk associated with CC.

**Keywords** – cloud computing ; policy; university administration; cloud based services

1. INTRODUCTION

Like other organizations, universities and higher education institutes need to use Information Technology (IT) services such as email, sharing space, web base services, and the Internet. Academic institutions often have many requirements that have special characteristics, and these must be considered carefully to fit the needs of different students. A technology can easily become outdated with limited IT resources and heavy workloads for administrative teaching and learning activities. In regard to this, cloud computing (CC) is one of the newest paradigms which can meet all the requirements.

Cloud computing (CC) has recently reshaped the IT industry as a service-oriented computing and its definition varies according to the authors; however, a comprehensive definition has been described by the National Institute of Standards and Technology (NIST) which explains CC simply as a model[1, 2]. More precisely, NIST defines CC as ‘a model for enabling convenient and on-demand network access that can be rapidly provisioned and released with minimal management effort or service provider interaction’. CC promotes availability and is constructed with five important characteristics, three service models, and four deployment models [3].

In a business and academic environment, the usage of cloud computing has been discussed for several reasons. CC is believed to reduce the costs of implementation and maintenance, enhance the mobility of a global workforce, and can be used without being installed on individual computers. Moreover, it encompasses flexible and scalable infrastructures, provides quick access to the market, and allows IT department transformation; where focus can be shifted to innovation rather than maintenance and implementation only [4]. However, the beneficial characteristic of cloud computing is neglected by some organizations, including university. In order to comprehend the reasons behind their preference on other software packages, we conducted interviews in conjunction with other factors, which are classified into policy, security, and applicability.

The remainder of the paper is organized as follows: In Section 2, the related works are reviewed and staff requirement and the cloud based solution found and categories, the gap identified. In Section 3, the methodology used for carrying out this research is described. Analysis and detailed discussion of the result is presented in section 4. Section 5 details out conclusion and possible future works that can be carried on this subject matter.

2. LITERATURE REVIEW
A. What Cloud Computing is

Cloud computing refers to a computing platform that is able to dynamically provide, configure, and reconfigure servers to address a wide range of needs, ranging from scientific research into e-commerce[5]. National Institute of Standard and technology (NIST) defines the five fundamental characteristics of CC as:

- On-demand self-service - customers can manage their requirements without referring to a cloud provider [3, 6];
- A broad network access - provides access to services over the internet or private network [3, 6];
- Resource pooling - allows users to access their resources through a pool of computer resource which is usually remote [1, 3, 6];
- Rapid elasticity - refers to capabilities that can be elastically provisioned and released [1, 3, 6];
- Measured service - service used by customers are measured before the customers pay accordingly [1, 3, 6].

Cloud computing is a kind of IT application and infrastructure that works out of the boundaries of an organization's local data center. In the context of a university, CC can be used as an out-of-campus or on-campus computing system [6]. Most organizations have employed this system because it can significantly reduce their costs [7-9].

B. Cloud computing service model

Commercially available operating systems can be divided into three categories according to the level the system interfaces with the software platform (see Figure 1) [1, 3, 10-12].

![Cloud Service Model](image)

- Infrastructure as a Service (IaaS): in which, IT infrastructure is deployed in a data center provider for virtual machines. A client has to install his own operating system and applications before he or she can rent the processing, storage, networking, and other basic computing resources for all purposes. IaaS is also called Hardware-as-a-Service (HaaS) [1, 3, 10-12].
- Platform as a Service (PaaS): PaaS as the “prerequisite of a complete platform, i.e. hardware and software, as service”. Platform-as-a-Service often remains invisible to the user as it provides the necessary operating platforms for the virtually provided applications. Thus, PaaS extends the role model of the SaaS ecosystem to the platform provider as an additional actor. [1, 10, 11, 13].
- Software as a Service (SaaS): Under this layer, applications are delivered through the medium of the Internet as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management. This type of cloud service offers a complete application functionality that ranges from productivity (e.g., office-type) applications for programs such as those of Customer Relationship Management (CRM) or enterprise-resource management [1, 3, 10-12].

C. Popular cloud computing Application
• Google Apps: Google Apps is a suite of web-based applications from Google composed of communication and productivity tools. These include messaging including Google messaging tools like Gmail, Google Talk, and Google Calendar[14]. All documents are stored on Google’s servers, and are accessible anywhere there is an internet connection. Google Docs also allows for real-time collaboration on documents, so that team members can edit a document at the same time[15].

• Amazon Web Services: These are a collection of remote computing services that make up a complete cloud computing platform which is offered over the Internet by Amazon.com. Amazon Web Services provides online services for other web sites or client-side applications[16]. Although most of these services are not exposed directly to end users, their functionality is accessible by other developers. It utilizes a hosted framework running on the web-scale infrastructure of Amazon Elastic Compute Cloud (Amazon EC2) and Amazon Simple Storage Service (Amazon S3). EC2 is a service that allows the creation of virtual machines to run on one of Amazon's data centers. Amazon S3 is a storage system for the Internet which is designed to make web-scale computing easier for developers. Moreover, it provides a simple web services interface that can be used to store and retrieve any amount of data at any time and place convenient to the user [17].

• Drop box: is a cloud-based storage solution that allows users to store up to 2GB of information for free and accessible wherever the web is. It allows user to share files with other[18].

• Doodle: is suitable for scheduling a meeting with multiple people. Doodle (http://doodle.com) is an application that allows a meeting planner to start the planning with a set of initial dates and time. Doodle send email to people who invited to meet and highlight the optimal time and fix the time after all of them replied to[18].

D. Computing Services for University

Universities, like other organizations, require services such as email, storage, financial transaction which need cloud computing applications, models, and services to meet their requirements. In fact, many university staffs have already used cloud technologies in their personal life [19, 20]. By using a cloud model and applications based on a cloud, they can work and communicate in their educational environment at their own convenience. With CC, the system administrators can obtain general processing, storage, database management, and other resources and applications through the network. The rest of the administrative staff will benefit from these services and infrastructure 24/24 from all places at low costs [19].

The activities of a university can be generally categorized into three main categories, i.e., research, teaching, and administration [19, 21, 22]. Research and teaching are two fundamental activities of universities. The main personnel in a university are the students, academic staffs, administrators, and non-academic staff. Examples of non-academic staffs include IT staffs, technicians, and clerks [19, 23, 24]. The focus of this study is on the administrators and non-academic staffs. The generally required services by the administrators and non-academic staffs are summarized in Table 1.

Table 1 categorizes the mentioned staffs’ requirement based on their job position. Review of existing work about CC showed that CC providers, provide an equivalent service to meet staff's requirements. Thus, based on Table 1 and related works on cloud solutions for universities, the appropriate cloud base application is found and proposed in Table 2. In Table 2, cloud based solution introduces and the service which can offer determined. The finding in Table 2 revealed that CC exactly able to meet all requirement with less implementation cost and complexity. However, despite of the abilities of cloud computing to cover all required services of the administrators and non-academic staffs, most universities remain doubtful towards the usability of CC [25, 26].
### TABLE 2: Cloud-Based Solutions for Staff Requirement

<table>
<thead>
<tr>
<th>Service</th>
<th>Email</th>
<th>Business Intelligence</th>
<th>E-learning</th>
<th>Microsoft Office 365</th>
<th>Online document viewing and editing</th>
<th>Student lifecycle</th>
<th>Sharing space</th>
<th>Storage</th>
<th>Scheduling meetings and other appointments</th>
<th>Virtualization</th>
<th>Security</th>
<th>Acquisition</th>
<th>Accounting-financial</th>
<th>Case management</th>
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3. METHOD

This research used the mixed method research. According to the definition, mixed methods research involves both collecting and analyzing quantitative and qualitative data and allows the researcher to draw more substantive conclusions [27].

A. Quantitative part:

A comprehensive research, meta-analysis, has been conducted based on the latest cloud computing articles that focus on the usage of CC within universities and the authors’ experiences in IT and higher education. Each reviewed study was evaluated in terms of data and processes, functions, and applications from several major universities. In addition, a correspondence has been created between the aspects under security and the models, services, and applications that are currently available in the cloud market.

B. Qualitative Part:

The qualitative part of this research involves using case study[28, 29] to answer the research question “What is the main reason of repudiation of cloud computing for university administrative activities?” In this research, the possible applications of cloud computing in educational institutions include drop box, Google App, Microsoft Live, Amazon Web Services (AWS), Doodle, Microsoft Office 365, and the Cloud-Based Firewall Service. The chosen university in Malaysia has been chosen as the focus of this case study since it is one of the biggest universities in Malaysia and has an established Center of Information and Communication Technology (CICT) which is responsible for the study and adoption of new IT technology.

A case study method enables the researcher to closely examine the data within a specific context [30]. The staffs at CICT are, generally, the administrators, IT staffs, technicians, and clerks. The required services of each category of staff have been previously recognized in Table 1, and the cloud-based applications have been assigned to each position appropriately in Table 2. The samples were purposefully selected at random from the sampling frame to participate in this study [31]. Ten people were chosen to be interviewed, namely two administrators, two technicians, two clerks, and four IT staffs.

A semi-structured interview was used to find the reasons why cloud computing system at the university administrative level is less/not utilized. Each interview was structured around one main issue. The interviewees were first asked for their position and then the services needed in their work place before more detailed questions were being posed. The outcome of the interviews should be seen only as opinions and anecdotes for using other kinds of computing technology [23]. Interviews are well-suited to collect data in this case study and for exploratory research since it allows extensive discussion for illuminating factors of importance in the CC adoption by universities [32, 33]. The qualitative data were subsequently analyzed to understand the reasons of ignoring CC-based applications in the chosen university.

4. RESULTS AND DISCUSSION

A. Quantitative Data Analysis

This analysis includes closed-ended information collected using a closed-ended checklist on which the researcher will check the behaviors seen. Statistically analyzed scores are collected using suitable instruments, checklists, or public documents to answer the research questions or to test hypotheses [27]. In this study, the SPSS software was used to carry out the analysis.

- Job positions and its related services: The first question (Q1) to the respondents is, “what is your position in the university?” and the second question (Q2) is, “what are the services related to your work?” The results are as summarized in Table 3. Figure 2 shows the graphical depiction of services required by the different staffs. Results from Figure 2 shows that it is corresponded to the results that were found in literature review as shown in Table 1 earlier.
CC familiarity and usage for personal and work purpose: To find out the level of familiarity of CICT employee with cloud computing service (CCS), the participants were asked on their familiarity with any CCS. 70% of the respondents said that they were, while the rest were not familiar with any CCS. Moreover, 80% of the respondents had used a CCS while the rest had not. From the 80% of respondents who said that they had used a CCS before, only 20% of them used these applications for job-related purposes.
In order to find out if there is a statistically significant relationship between job position and the usage of a cloud computing service regardless of job-related or personal purposes, the Pearson correlation test has been carried out. The results are as depicted in Table IV.

**TABLE 4: Relationship between Familiarity and Usage of CC among staffs of different job positions**

<table>
<thead>
<tr>
<th></th>
<th>Familiarity</th>
<th>Mean Square</th>
<th>Sig.</th>
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<tbody>
<tr>
<td></td>
<td>Between Groups</td>
<td>.117</td>
<td>.758</td>
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<td></td>
<td>Within Groups</td>
<td>.292</td>
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<tr>
<td>Use CCS for Personal Use</td>
<td>Between Groups</td>
<td>.050</td>
<td>.358</td>
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<td></td>
<td>Within Groups</td>
<td>.125</td>
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<tr>
<td>Use CCS in work place</td>
<td>Between Groups</td>
<td>.533</td>
<td>.01</td>
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<td></td>
<td>Within Groups</td>
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</table>

The correlation result showed that the staff’s familiarity with CCS (sig=0.272) and usage of CC-based services in personal life (sig=0.719) are not significantly related to their positions. However, its usage in job-related works are significantly related to the personnel’s job positions (sig=0.007<0.05).

- **Differences with Job Position:** Moreover, to know whether there is any statistically a difference in the level of familiarity and usage of cloud computing services for personal and working purposes, a comparison has been made among the four job positions using the one-way ANOVA test. Results indicated that not much difference can be observed. In the measurement of familiarity level among administrators and employee of different positions, the usage of CCS in personal life is not significantly different among the groups. It is only significant when job-related purposes are taken into account (sig=0.01).

A comparison through the mean test confirmed the results of the Pearson correlation test, which stated that only job-related purpose induces significant difference within different job positions.

**TABLE 5: Differences between familiarity and usage of cc for different job positions**

<table>
<thead>
<tr>
<th></th>
<th>Using CCS for Personal Use</th>
<th>Using CCS for Working purpose</th>
<th>Familiarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.131</td>
<td>.784**</td>
<td>-.385</td>
</tr>
<tr>
<td>Sig. (2-tailed) N</td>
<td>.719</td>
<td>.007</td>
<td>.272</td>
</tr>
</tbody>
</table>

**B. Qualitative Data Analysis**

Qualitative data analysis entails the usage of open coding [34] as a process of identifying, naming, categorizing, and describing the data [35, 36]. This open coding provides a list of intellectual bins or seed categories [37]. In this study, four categories have been coded as the reasons that have caused a lack of interest in using cloud computing at the chosen university. The category includes security, accessibility, policy for acceptance of cloud computing, and applicability.

- **Policy -** In the chosen university, cloud computing has been refused due to an internal organization policy of cloud-based application. A respondent said that, “we should use the facilities provided by university authorities (workplace)”. Another respondent said that, “we use the application provided by university, university email
Services, Web”. The third respondent believed that, “we use the facility provided by the chosen university to store and share our data”. Most respondents gave the same response. Moreover, this result is in line with results published for the role of CC in an organization [44-46].

- **Security** - Security is one of the important concerns of the respondents, especially when the data is out of their local networks. This corresponds to the results published by Rajkumar Buyya [38], Tharam [Dillon [1], Krešimir Popović [39], Yi Wei[40], and Takabi [41]. They mentioned that the security issue is one of the main concerns that govern the acceptance of cloud computing in an organization. The path to secure CC is surely a long one, and it will require the participation of many stakeholders on a global basis. Nevertheless, new cloud security solutions are continually published around traditional issues such as data and resource access control, encryption, and incident detection.

- **Inapplicability** - Inapplicability is also one of the factors for repudiation of cloud-based services in the chosen university. Some respondents believed that cloud-based services are not applicable to their work due to the duties assigned to their positions. One of the respondents expressed that, “we are technicians and work on hardware, so the existing cloud-based services are not applicable for us”. The findings of the research contradict the results of previous studies regarding inapplicability [42-44].

5. **CONCLUSION**

This study was carried out to find the reasons for ignorance of cloud computing at chosen university. The preliminary results revealed that the staffs repel the usage of cloud-based applications although most of them are familiar with a certain number of applications. The respondents felt that the policy issue played an important role in preventing the usage of cloud-based applications. In addition, security, accessibility and inapplicability, have further hindered its usage. Base on the finding of this paper, the main reason for adoption of cloud computing as a choice for a university, is policy. While cloud computing is expanding rapidly as a service used by a great many individuals and organizations internationally, policy issues related to cloud computing are not being widely discussed or considered. One of the major concerns of consumer in related to CC are security, privacy, and anonymity. However by using a proper policy this risk could be reduced. One obvious solution is for users to encrypt whatever data resides in the cloud. This solution is sufficient for the storage of data.

Another question regarding the CC is access and usage restrictions. Privacy in this case means protection of copyright in types of materials stored on and shared through clouds. Many companies have already provided contextualized ads, based on keywords, Web sites viewed, and other forms of automated learning of users’ activities and content; to protect data privacy. However, some questions still linger as such; are the users accepting it. Gmail is a good example, in this regard indicates that users will accept these strategies in e-mail systems in exchange for increased convenience, storage capacity, and searching ability, if the success of Google’s Gmail is any indication. However, despite all the concerns of policy, It cannot be ignored that cloud computing can bridge the certain gap in access to digital content. In addition, it reduces the implementation cost and requirements on local hardware that individuals have to purchase. However, there are significant uncertainties about and tensions between public policy and technological capacity in the development and provision of cloud computing, as it could be seen as a wave of IT technology. In one hand are security concerns but in other hand, consumers need not worry about security concerns. Because security can be guaranteed for users by providers as a result of government surveillance and data collection activities. Future research will need to include other universities to cover the reaction of the general university’s population towards CC.

**ACKNOWLEDGMENT**

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