Define the Factors Affecting the Shift to Cloud Computing in Malaysian Universities

Hajer Ahmed Albahaloul, Fatma Susilawati Mohamad, Khaled Alhadi Meftah

Abstract: Cloud computing is the way to increase capacity without vital investment in new infrastructure, training new personnel, or licensing new software [1]. As higher educational sectors are under growing pressure, and to provide more for quality education [2] in the current financial crisis and the increasing need, universities can utilize the potential benefits of cloud computing to provide improved services with few resources [3].This paper presents a comprehensive study on the obstacles and advantages in cloud computing which affected at shifting to cloud computing services in Malaysian universities, and comparison of this present research results with the previous studies.

Index Term: key words: Cloud computing, Cloud Services, Malaysian University

I. INTRODUCTION

Some researchers have estimated that cloud computing can save about 50 percent of costs if the enterprise relies on cloud computing. However, estimates differ because they are based on many factors, such as the extent to which the enterprise uses technology, the model on which technology is based, user characteristics, and the quality of the data they use, among other factors such as [4] and Malaysian university staff. Using students and staff - in higher education - as a sample, this study examines whether they know that cloud computing is common among university staff. The results of the analysis indicate that the knowledge of cloud computing services very common among the university sample in Malaysia who participated in this study. It was found that 168 participants (75.0%) already knew about cloud computing and its services. Only a quarter of respondents (56; 25.0%) did not have such knowledge. This discovery supports the Knowledge that cloud computing and its services are widely distributed in Malaysian communities.

II. LITERTATUREREVIEW

Review of the literature led the researcher to a very recent, comparable local study, which helped the researcher to hold comparison

between findings of both studies and to track changes over a two-year period of time in cloud computing related as mentioned at research [5] who investigated the cloud computing services and applications that are needed to improve the productivity of researchers in four Malaysian universities (Universiti Kebangsaan Malaysia,

University Technology Malaysia, University of Malaya, and Universiti Tenaga Nasional). For this purpose, thirty Malaysian and non-Malaysian graduate students were interviewed in 2013. These researchers found that (i) 88.9% of the study sample lack knowledge about cloud services and applications, and (ii) only 18.5% of the study sample used cloud computing services and knew about them. The researcher thinks that the difference in proportion of people knowing about cloud computing services between the current study (75.0%) and that of [5] can be ascribed to the larger number of Malaysian higher education institutions sampled in the present study than in the study of Shakeabubakor et al. (2015); 22 and 4, respectively, and to the larger sample size in the former (N = 224) than the latter study (N = 30). Additionally, the researcher thinks that time contributed to this difference (75.0% vs. 18.5%), presuming that more and more people become aware of cloud computing and it's with time by virtue of the increased maturity of the cloud computing infrastructures and the growing awareness of cloud computing and of its potential in Malaysia.

This explanation meets with that of researchers [6] who stated that users' security concerns about cloud computing can, to a great extent, find roots in immaturity of the cloud technology and to unfamiliarity of the users with the cloud environment. Thereupon, it seems that as cloud computing develops, more and more people, especially non-users of the cloud, recognize its potential and tend to shift to the cloud computing environment and to cloud services. In addition, it appears that the users tend to adopt more cloud computing services and features services as the days go by. In Croatia the researchers analyzed and interpreted results of a study of cloud computing in the University of Rijeka to provide indications of the students' willingness to shift to cloud services [7]. These researchers found that 12.0% of the participants (N = 158) were not familiar with cloud computing services whereas 88.0% of the sample students agreed with that cloud computing education services must be implemented in the schools. Upon comparison, the researcher realizes that members of the university community in Malaysia enjoy a higher level of knowledge of cloud computing than people in a number of countries, including Croatia and India.

At the organizational level, and for comparison purposes, A study conducted by [8] explored the reasons behind the slow rate of the adoption of cloud computing at the university level in the Asia Pacific University of Technology and Innovation (APU) in Malaysia, which has already adopted and implemented the cloud computing technology, and discussed the challenges which adoption faces. These researchers found that the top three barriers to cloud computing adoption in APU were concerns about (i) confidentiality and security of data, (ii) privacy and regulatory compliance, and (iii) reliability of service providers. In an additional example, [9] presented and discussed results of a research survey designed to explore the obstacles that prevent organizations in the UK from adopting clouds, with particular focus on security issues. The survey was designed to capture opinions on cloud computing from an organizational standpoint. Sixty seven percent of all respondents (N = 28) belonged to an educational business and, of all, eighty one percent were working in organizations with more than 1,000 employees. According to the survey results, approximately 92.8% of the respondents were aware of cloud computing. This high percentage, especially if compared with the results of the current study (75.0%), can be explained by the fact that the sample respondents in the study of Moyo and Bhogal (2014) were using cloud services supported by their organizations rather than on an individual basis. In the research [10] and the references therein, it was underlined that security concerns and responsibility in the IaaS, PaaS, and SaaS service models are somehow different. The study of [11] Reviewed published literature on the cloud computing topic from 2010 to 2015 to identify the factors which influence adoption of cloud computing. They highlighted that the five studies which investigated educational adoption of the cloud computing technology identified the main factors that affect adoption of cloud computing by educational institutions to be risk, privacy and security, adoption cost, and performance expectancy [12]. According to [6] which Examined acceptance of cloud computing services by government agencies in Korea with a focus on the main characteristics affecting behavioral intention. The study extended the TAM by including four contextual variables: access, availability, reliability, and security. The modeling results illustrated that user's intention to use cloud services and her/his adoption behaviour were influenced largely by the four studied cloud service factors (accessibility, availability, reliability, and security). A number of researchers (e.g., [13]) who spotlighted that trust is the main barrier that prevents enterprises and individuals from adopting cloud services. The researchers [11] employed the unified theory of acceptance and use of technology (UTAUT) Unified Theory of Acceptance and Use of Technology (UTAUT) [14] model. According to the UTAUT model, performance expectancy, effort expectancy, social influence, and facilitating conditions are the four potential constructs to explain user perception and acceptance behaviour. Besides trust and security, as a theory of cloud service adoption.

III. RESEARCH METHODS

This study is exploratory in nature and the data were gathered by using self-administered survey questionnaires. The questions were divided into four parts. Respondent's demographic profiles were asked in Part A. Part B contains the about knowledge questions of cloud computing question and reasons for non-adoption for respondents who choose 'NO' as their answer for non- knowledge. the third part include the security of users' information in the cloud and the security issues which users are concerned about it, these security issues include data Integrity, data loss, privacy, data theft and control of access to the data.

The last part requires the respondents to indicate the benefits of cloud computing, services that they use from the list provided and their expectation of cloud computing diffusion in the future. The researcher followed the survey questionnaire, which based on studied of issues of cloud computing and the confidence extent of users to trend to this service, in addition , provide better visibility to the cloud providers, that was done through design a questionnaire to assess this issue. And dealing with the distribution of the questionnaire by universities and institutes of higher education sector was selected randomly. Thus, the required of selected of the sample is offering the diversity, not specific type of universities, so as to determine the prevalence of concept of cloud computing at higher education in Malaysia.

Universities personnel were chosen as the sample as they are expected to be more forthcoming in using information technology based on their work or study nature and prior exposure. The results notice that the largest number of respondents for 60 (25.64%) were working or studying University Technology Malaysia. Universiti Tun Hussein Onn Malaysia had the close and second highest representation in the study sample as 58 (24.79%) of the participants in this study were staff and students of this university. Further, results show that a slightly lower representation of Geomatika University College was found in this study as only 40 (17.09 %) members of the community of this college took part in the present study Limkokwing University of Creative Technology and Infrastructure University Kuala Lumpur had somewhat comparable representation in this study (34 (14.53 %) and 32 (13.68 %), respectively). Out of 300 questionnaires, 244 were completed and returned (81.33% response rate) and they were used for further analysis. The demographic profiles of the respondents are as follows With reference to gender, the analysis outcomes reveal that 150 (67.0%) of the total 224 respondents were men while women were about half this number (74; 33.0%). As far as the respondent's career is concerned, the vast majority of the participants in this study were students (175; 78.1%). While 'Administrators' ranked next (27; 12.1%), few and almost similar numbers of respondents were managers (8; 3.6%), heads of departments (7; 3.1), and 'Others' (6; 2.7%).

The results point out that knowledge of Cloud Computing is very common amongst the sample university personnel in Malaysia who participated in this study. It was found that 168 participants (75.0%) already know about cloud computing and its services. Only one fourth of the respondents (56; 25.0%) did not have such knowledge. This finding supports that knowledge of cloud computing and its services is appreciably prevalent in communities of the Malaysian universities, including staff at various career levels and students. [5] Investigated the cloud computing services and applications that are needed to improve the productivity of researchers in four Malaysian universities (Universiti Kebangsaan Malaysia, University Technology Malaysia, University of Malaya, and Universiti Tenaga Nasional). For this purpose, thirty Malaysian and non-Malaysian graduate students were interviewed in 2013. These researchers found that (i) 88.9% of the study sample lack knowledge about cloud services and applications, and (ii) only 18.5% of the study sample used cloud computing services and knew about them. The researcher thinks that the difference in proportion of people knowing about cloud computing services between the current study (75.0%) and that of [5] can be ascribed to the larger number of Malaysian higher education institutions sampled in the present study than in the study of Shakeabubakor et al. (2015); 22 and 4, respectively, and to the larger sample size in the former (N = 224) than the latter study (N = 30). Additionally, the researcher thinks that time contributed to this difference (75.0% vs. 18.5%), presuming that more and more people become aware of cloud computing and it's with time by virtue of the increased maturity of the cloud computing infrastructures and the growing awareness of cloud computing and of its potential in Malaysia. This explanation meets with that of the study of [15] who stated to the users' security concerns.

IV. FINDINGS

Table 1: The Cloud Computing services that the sample university personnel used

Service	Frequency	Percent
1. Cloud storage services: Google Drive, Dropbox, and Sky Drive[1].	130	58.0
2. E-mail services: **Gmail**, Yahoo, and Hotmail.	183	81.7
3. Cloud music services: Google Music, Amazon Cloud Player.	59	26.3
4. Cloud applications: Google Docs, Adobe Photoshop Express.	68	30.4
5. Cloud operating systems: Google Chrome OS.	61	27.2
6. Other	3	1.3

1. SkyDrive has been renamed by Microsoft to OneDrive.

Based on the table 1 identifying the cloud computing service types which the sample university personnel formerly used. To this end, five principal services were listed in the survey (and responses of the sample members to these items were analyzed for frequency of distribution. The main findings were as follows (Table 1) that all listed cloud computing services were used by the respondents. Each sample member used more than one of the five major listed cloud computing services, also the cloud computing service which was used by the highest number of respondents (183; 81.7%)) was e-mail services (Gmail, Yahoo, and Hotmail).The second most widely used cloud computing service was cloud storage services (Google Drive, Dropbox, and Sky Drive). These services were used by 130 individuals (58.0% of all respondents), three cloud computing services were used by somehow close numbers of sample members: cloud applications (Google Docs and Adobe Photoshop Express (68; 30.4%)); cloud operating systems (Google Chrome OS (61; 27.2%)); and cloud music services (Google Music and Amazon Cloud Player (59; 26.3%)).

The foregoing findings that the most broadly used cloud computing service was e-mail services (Gmail, Yahoo, and Hotmail). This percentage is higher that the percentage reported by [5] who mentioned that 33.3% of their sample of graduate students in four Malaysian universities never used cloud applications but they have e-mail accounts and similar other accounts. The difference in percentages between the two studies can be related to the different sample sizes and numbers of universities surveyed in both studies [7] investigated whether or not students of the University of Rijeka (Croatia) need applications and services in the cloud, the extent of use of cloud computing services, and the types of cloud services and applications they use. The study results showed that the cloud needs of the sample university students (N = 158) decreased in the order: communication software, multimedia sharing, cloud docs/office software, cloud storage, and file synchronization software. In terms of frequency of the use of cloud services, the order of services was only slightly different; communication software, multimedia sharing services, learning services, storage and file synchronization software, and cloud docs/office software.

The second most widely used cloud computing service (130; 58.0%) was cloud storage services (Google Drive, Dropbox, and OneDrive (formerly known as SkyDrive)). Based on this finding, the researcher concludes that the university community has high demand on secure, free storage means and facilities where individuals can have spare copies of their files, especially large files, for easy access any time later from any place (i.e., broad network access [12] and for file sharing. The attractive features of these services include that resources on the cloud are available for access from a broad range of devices like laptops, workstations, smart phones, and tablets, amongst other devices.

Define the Factors Affecting the Shift to Cloud Computing in Malaysian Universities

The present study found that the second most widely used cloud computing service was cloud storage services. These services were used by 130 individuals (58.0% of all respondents). Some researchers found that 54.0% of the respondents to the [16] survey either use cloud-based storage or plan to implement it in the near future. They documented that all the education institutions in their study reported use of IaaS, PaaS, and SaaS, and that the most common use of the cloud was for storage (69.0%). In specific, almost 51.0% of the respondents revealed storing 25.0% or less of their data in the cloud while 49.0% used the cloud to store 25.0% or more of their data. Further, about 53.0% of the sample members used the cloud for curricula and digital content while 46.0% used it for software and services. In this regard, the most popular types of digital content that had been archived in clouds were editorials/texts (62.0%), animations and videos (56.0%), images (54.0%), Web design/applications (49.0%), and sound and audio files (43.0%). However, the researcher maintains that it was found in table1 that the cloud computing service used by the vast majority of the sample members

(183; 81.7%); is e-mail service (Gmail, Yahoo, and Hotmail)

Table 2: Type of Cloud Computing service used by the sample university personnel

Service Type	Frequency	Percent
1-Software as a Service (SaaS); e.g., Google Apps, Salesforce.com, etc.	115	51.3
2- Platform as a Service (PaaS); e.g., Windows Azure, Force.com, Google App Engine, etc.	80	35.7
3- Infrastructure as a Service (IaaS); e.g., Private cloud, VMWare, Amazon EC2, etc.	66	29.5
4. None.	63	28.1

And based on which of the types of the cloud computing services used within the three major service categories: IaaS, PaaS, and SaaS, and responses of the sample members were as follows (Table 2) that approximately half the respondents (115; 51.3%) identified the cloud computing service type they formerly utilized as SaaS. While nearly one third the respondents (35.7%) classified the cloud computing service type they utilized previously as PaaS. Slightly less than one third of the sample members (29.5%) recognised the cloud computing service type they used to utilize as IaaS. This service type offers the users elements of networking and data storage and processing. Also sixty three (28.1%) of the sample personnel indicated that the cloud computing service type they used to utilize was none of the three investigated service types (IaaS, PaaS, and PaaS), Alotaibi et., al [17] observed that use of clouds by even the IT professionals in Saudi Arabia was at the level of the SaaS cloud service model owing to that not all of them had chance to work with the cloud at other than the application level. In their exploration of the perceptions of cloud computing of higher education professionals. Moreover, the researcher presents findings related to the main point: if members of Malaysian universities see that Cloud Computing services are safe for their personal data.

Analysis results (Table 3) revealed that almost three fourths of the sample members (166; 74.1%) see that cloud computing is safe for their personal data. This percentage is higher than what was obtained by (Mayo et. al [9]) who documented that 65.0% of the respondents in their study strongly agreed with that cloud computing is secure. On the other hand, only about one fourth of the respondents in the current study (58; 25.9%) revealed that they do not see cloud computing as safe for their personal data. This implies that most of the sample Malaysian university personnel have high levels of trust in the cloud computing services and service providers.

Table 3: Respondents' views on safety for their personal data

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	166	74.1	74.1	74.1
No	58	25.9	25.9	100.0
Total	224	100.0	100.0	

Moreover, the researcher attempted to identify the most useful features of cloud computing services from the viewpoints of university personnel in Malaysia. Through literature review, the researcher could identify six useful features of cloud computing services. The main findings are: that cloud computing feature which the largest number of respondents (102; 45.5%) stressed its usefulness was 'Sync files (one can reach any file submitted to the cloud and modify it from any computer)'. From the standpoint of the study sample, the second most useful cloud computing feature was that cloud computing ensures accessibility to all applications and services provided by the company from anywhere, anytime via the Internet (i.e., availability or ubiquitous access). Eighty one respondents, corresponding to 36.2% of the study sample, supported usefulness of this feature. Nearly equal numbers of the sample members highlighted two cloud computing features as useful: file sharing (one can upload large files to cloud storage sites and then send them via e-mail (76; 33.9%)) and collaboration cloud computing services (e.g., Google drive) provide team works and groups with services that allow collaboration and group editing (74; 33.0%).The finding showed the least useful cloud computing feature from the viewpoint of the sample Malaysian university personnel was saving and sharing photos. Only 51 individuals (22.8% of the sample members) supported usefulness of this feature ,and the second least useful cloud computing feature according to the sample Malaysian university personnel was taking an extra copy of files and data. Merely 64 individuals (28.6% of the sample members) supported usefulness of this feature.

This study outcome leads the researcher to the conclusion that the sample members think of cloud computing more of an active environment and means of interactive communication and file processing than a storage facility or option. The current study found that the cloud computing feature which the largest number of respondents (102; 45.5%) stressed its usefulness was 'Sync files'. This means that a substantial proportion of the sample respondents using this service. However, the exact percentage of those could not be specified. In the study of [5] it was found that 18.5% of the graduate students in the four studied Malaysian universities used to synchronize their own research works on the cloud. From the viewpoint of the study sample, the second most useful cloud computing feature was that cloud computing ensures accessibility to all applications and services provided by the company from anywhere at any time via the Internet (ubiquitous access). Eighty one respondents, corresponding to 36.2% of the study sample, supported usefulness of this feature. Upon review of the literature, this percentage seems to be low, even though it is still somewhat close to the percentage associated with usefulness of synchronization of files (45.5%), which was ranked by the university personnel in this study as the most useful cloud computing feature. In comparison, [18] mentioned that 87.0% of the participants in the survey of (CDE, 2013) believed that the 'anywhere, anytime' access to educational resources was the major benefit of mobility. Thus, aforementioned findings lead the researcher to conclude that the most useful features of cloud computing and its services from the viewpoint of the participants in this study are easy access to data, the possibility of processing the accessed data, and file sharing; the latter two points emphasize cloud computing as an active medium or environment for data sharing and handling. Approximately one third of the participants (34.0%) highlighted file sharing as one of the most useful cloud computing features. File sharing is one of the facets of resource pooling. It establishes the sense of availability of infinite resources that are scalable and readily available for meeting user's demands [12].

V. CONCLUSION

The objective of this study is to measure the level of awareness of cloud computing among Malaysian universities, and compare the results of this study with the previous studies, to discover the main reasons of not adoption of cloud computing service in the higher educational sectors in Malaysia. Using questionnaire survey to achieve the objectives, the findings provide interesting insights. It shows that regarding to main distracting Cloud Computing disadvantages:

- This study found that fear from security threats was the cloud computing disadvantage worrying the largest number of the sample members (129; 57.6%). Data loss was the cloud computing disadvantage worrying the second largest number of the sample members (101; 45.1%). Interruption of the Internet was the cloud computing disadvantage worrying the third largest number of the sample members (96; 42.9%).

- Two other cloud computing disadvantages were distracting, but to a lesser extent: threats to privacy (84; 37.5%) and non-control of the services (80; 35.7%),In high agreement with their views on safety of cloud computing for their personal data, most of the sample university personnel (167; 74.6%) expressed their trust in that private companies can protect their information. People expressing distrust counted 57 and represented 25.4% of the study sample. Moreover, the vast majority of the respondents (146; 87.4) who trust that private companies can protect their information support that private companies are safer for personal records on-line than free companies. People holding the opposite view were only few (21; 12.6%).

- From a theoretical standpoint, this research contributes to the body of research that investigates adoption of cloud computing from the individual user's perspective in higher education institutions in Malaysia, acknowledging the roles of security and trust perceptions in the adoption decision. To the researcher's best of knowledge, this study uncovers that while there are numerous critical issues to consider for boosting diffusion of the cloud technology in the higher education sector in Malaysia, the cloud has a lot to offer to post-secondary education. Attitudes to technology and its use in the Malaysian higher education institutions are positive. Outcomes of this survey reveal bright future for further penetration and diffusion of cloud computing in higher education in Malaysia. The study contributes to understanding of the determinants of cloud computing adoption in the higher education organizations in Malaysia so that effective cloud computing can be facilitated in these organizations.

- This study presents several major findings on, and underlines implications of, determinants of cloud computing adoption in the higher education institutions in Malaysia. Outcomes of this study may give university decision makers and the cloud computing vendors some deep insight into the critical factors which affect cloud computing adoption to utilize them such that higher diffusion of cloud services and applications is secured. The results of this study are useful in formulating better understanding of how specific challenges affect adoption, which may, eventually, result in more informed managerial decision making as regards the adoption of the cloud systems.
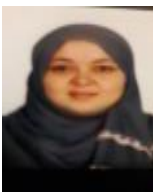
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