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A Review on Cloud Computing Acceptance Factors

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Abstract

Cloud computing technology is regarded as a highly useful application for organization due to advantages such as long-term cost saving, easy access of data at any given time and economically. In fact, there are lots of free cloud storage provider these days whereby user can easily store and shared their organizational data easily and efficiently. Both government and private sectors are looking into optimizing their cloud data storage. However, some of them are still in the early implementation phase with issues on both technological and human factors need to be properly taken care of to ensure its success. In the case of Malaysia our Government highly encouraged the use of cloud computing technology. Given that it is in the early implementation phase it is important to understand the factors that contribute to the use of cloud computing. This study, review studies done in health. Higher learning institution and public sector. It was found that the most contributing factors for use or cloud computing are technology readiness, human readiness, organization support, environment and, security and privacy. We hope that this study will help strengthen our knowledge and readiness in implementation of cloud computing.

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Keywords: Cloud Computing; Success Factor; Success Model; Health Care; Higher Education; Public Sector

Introduction

Cloud Computing (CC) has become an option for many organizations; particularly in curbing the current economic situation is forcing every decision made by deciding not to harm the organization. In the past, the physical data centre was a requirement and pride in the information technology, but now the physical data centre can already be forgotten when cloud computing technology provides data storage and other services at a cheaper price and very

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economical. A well-adopted cloud gives a lot of advantages to the organization such as easy and pervasive access to data and applications, increase cost effectiveness and build up competitive advantage [1]. The adoption of CC in the organization will increase a substantial saving with regards to capital expenditure and operational expenditure [1]. The purpose of this paper is to review the factors of cloud computing implementation studies that have been done before in three sectors; health care, higher education, and public sector. The objective of this review was to conclude the factors that dominated all three sectors. Is there another factor to certain sectors only? To find answers to the key questions, review using the Methodological Review and Theoretical Review was used. These three sectors were selected based on the observations obtained in a previous review that shows these sectors are among of the sectors which most implementing cloud computing.

1. What is cloud computing?

Cloud Computing is not a new thing, but it is the physical data centre technology evolution to virtual centre. National Institute of Standard and Technology (NIST) defined Cloud Computing 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 [2]. CC basically offers three types of services models; Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). SaaS is the highest level of the cloud of which all the services are offered by the cloud providers. Users who adopt PaaS only manage their applications and data and those adopting IaaS will have their infrastructure like server, storage and networking run by the providers.

There are three models of deployment – Public Clouds, Private Clouds and Hybrid Cloud. In public clouds, all the services offered by the providers are shared together with all the cloud users. Private clouds are deployed when the users need to enhance their data security to which the clouds are exclusively catered for them. The hybrid cloud is the combination of both public and private clouds. The adoption of these deployment and services offered depends on the needs and requirements of the organization.

2. Implementation of cloud computing

3.1 Cloud computing in healthcare sector

J. Abdullah and L. Seng applied a conceptual model of users' acceptance of cloud computing solutions to look at factors influencing acceptance of cloud computing technology among physicians and nurses worked in hospitals across Klang Valleys, Malaysia. Five key components have been employed in this study; Perceived Usefulness, Perceived Ease of Usage, Attitude Toward Use, Perceived Risk and Institutional Trust [3]. This study took 140 physicians & nurses working in Klang Valley's hospitals by using the TAM model. A multiple linear regression technique has been applied to analyze the finding. The outcomes have supported the hypothesis for variable Perceived Usefulness, Perceived Ease of Use, Attitude Toward Use and Perceived Risk. These four elements indicating significant relations and positively towards the intention to use cloud computing [3]. Model as shown in Fig 1.

Another study conducted in this area was from Alharbi, Fawaz Atkins, Anthony Stanier, Clare (2016) where they have conducted research on factors that influence the adoption of cloud computing in Saudi Arabia in the health sector. In this work, they used Adoption of Technology-Organization-Environment (TEO) & Human, Organization & Technology-fit (HOT-fit) framework. Five important factors were being assessed in this theoretical account which are Technology, Human, Business, Environment, and Organization. With the 354 respondents, the results of the study show that there are five main factors. (1) soft financial analysis, (2) relative advantage, (3) hard financial analysis, (4) attitude toward change and (5) pressure from partners in the business ecosystem [4]. This study is very interesting because it managed to identify critical factors that are useful to industry players and academics that influence adoption of cloud computing in the health sector.

Ahmadzada, Saleh Zayyad, Musa A Toy Can, and Mehmet conducted their research in the Republic of Azerbaijan to review the readiness of implementing cloud computing in the health system at the hospital around Baku, the capital of Azerbaijan [5]. More than 100 hospital staffs from private and public hospital are involved in the

sketch. The study found three main factors, namely, Societal, Technology and Core Readiness Constructs are high ranking. While Policy Readiness Statements Featured obviously at the lower ranking [5]. We may conclude that the majority opinion is positive towards the implementation of cloud computing for the health sector to improve the quality of services in line with current technology.

In Malaysia, another survey has been performed to assess the relationship between health insurance companies, health service providers and IT industry players in determining the adoption of cloud computing. In this study, six hypotheses have been developed; (1) An effective healthcare provision will have a positive influence on the efficiency, (2) An effective healthcare provision will have a positive influence on the extent of the collaboration, (3) IT Resources has a positive influence on the extent of efficiency, (4) IT Resources has a positive influence on the extent of collaboration, (5) An effective health Insurance provision will have a positive influence on the efficiency, and (6) An effective health Insurance provision will have a positive influence on the extent of the collaboration. A survey from 250 respondents is collected and been analyzed. The result showed adoption of cloud has significant impact within the Malaysia health care sector [6]. The key elements for the successful implementation of health care systems are the integrated data system. With the implementation of the integrated organization and adopting the cloud computing technology will manage operating costs effectively because of the ability to share information. Model is shown in Fig. 2.

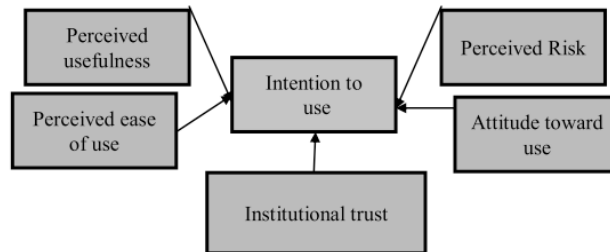


Fig. 1. Conceptual model of users' acceptance of cloud computing solutions [7]

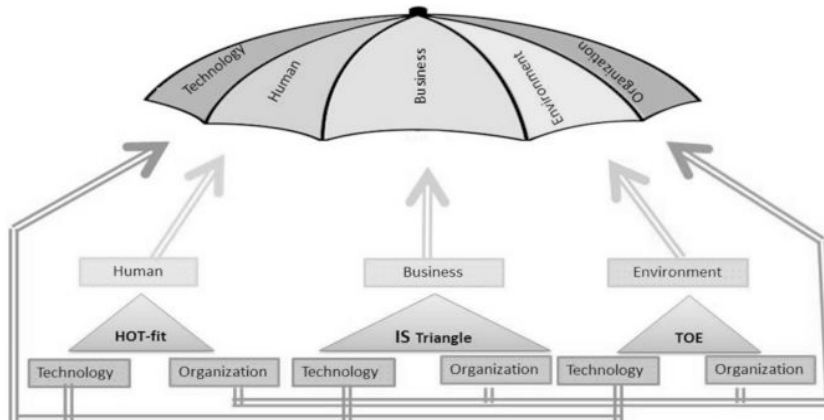


Fig. 2. The relation between HOT-fit, IS triangle and TOR and the research framework [4]

Another subject area has been performed by using TOE framework and HOT-fit model. This survey conducted by Lian, David and Wang to investigate the factors to adopt cloud computing in Taiwan hospital industry [8]. The four variables are quantified in this subject field; Human, Technology, Organization, and Environment. ANOVA technique has been used to analyze this subject area. At the end, a significant difference exists in CIO Innovativeness, Data Security, and Compatibility [8]. The others important factors are technology, human, organization, and environment.

Kusnandar and Surendro was conducted their study in Bandung, Indonesia [9]. The aim of the survey is to obtain an adoption model application of hospital information system based on cloud computing technology and taking into consideration the local culture. Management, admin staff, doctor, nurses and IT staff have involved in this survey. Structural Equation Modelling (SEM) was used to encounter out the relations between adopter's characteristics with organizational culture. The study should be able to recognize the outcome of hospital management against innovation diffusion element as well as against organizational culture. Ultimately, the study successfully showed the important function of local culture in ensuring the successful implementation of cloud computing. This is a good strategy input toward adoption of cloud computing at the hospital [9].

3.2 Cloud computing in higher education sector

Talal H. Noor in her research proposed a two-dimensional research model, namely motivators and inhibitors to examine the usage and the cloud computing adoption in Saudi Arabia [10]. An extensive statistical analysis was conducted on data gathered from more than 300 participants from 5 different universities in Saudi Arabia. Based on the results, they found that the two highest motivators for using Cloud computing from the perspective of Saudi Cloud consumers are ubiquitous network access and on demand (self-service) while the highest 5 inhibitors are availability, reliability, security, compliance, and privacy respectively [10]. Model is shown in Fig. 3.

In Romania, a group of researchers' dealings the positive shock of applying cloud computing architectures upon e-learning solutions development. A metric system has been developed which aims to evaluate the efficiency of cloud computing in the provision of e-learning materials. On that point, for each e-learning project that is using cloud technology, it is very dependent on the type of model used either SaaS or PaaS, IaaS. In addition, the cost of the project and risk management also influences the success of the e-learning project based on cloud technology [11].

Meanwhile, in Jordan, Bani-Salameh and Somia carried on the empirical investigation to propose an e-learning model that consists of nineteen critical success factors classified into five dimensions [12]. The five dimensions are human genes, interaction, courses, environment and feedback. The results were as expected positive for all hypotheses in their study such a result might be attributed to the reason that most of the e-learning projects are not managed by specialized technicians; where instructors usually play their role, contrary to large-scale e-learning projects [12]. So, for its importance, they consider it in their model.

In Malaysia, Shahzad, Golamdin, and Ismail have talked regarding benefits and challenges in adopting cloud technologies into the higher education system in Malaysia [13]. They found this technology provides a lot of benefits to higher education institutions, especially in the chasing world education ranking. But at the same time, cloud computing technology is also facing challenges such as security and privacy issues, lack of expertise and the problem of internet speeds in some areas. However, this technology is seen to have huge potential because of its ability to solve problems such as lower cost, information sharing, access and manage them more easily [13].

Badie, Che Hussin & M. Dahlan constitute the major reasons that have caused many universities in Malaysia are non-usage of cloud computing [14]. By constructing four hypotheses; (1) Inapplicability will be correlated with the adoption of cloud computing. (2) Security will be correlated with the adoption of cloud computing. (3) The policy will be correlated with the adoption of cloud computing. (4) Accessibility will be correlated with the adoption of cloud computing. Granting to the study, staffs resist to use of cloud-based applications, although most of them are familiar with a certain number of applications. The four main reasons for avoidance of organization found which were security, policy, accessibility, and inapplicability [14]. Although, most of the respondents felt that the security issue plays a significant function in promoting the use of cloud-based applications; the outcome indicated that policy is more important in comparison to security issues, and lack of proper policy has further hindered its use. In addition, also accessibility and inapplicability have a statistically significant relationship with the adoption of cloud computing but, this relationship was very weak compared to the policy and security issue of the cloud. Future researchers still need to include more universities in Malaysia to cover the reaction of many universities towards cloud computing adoption.

There is a study intended to analyze the obstacles to adopt m-learning among institutions of higher learning in Malaysia by Wan Ahmad & Sarlan [15]. They also see the use of cloud technology in resolving the problem. From the data collection, the result demonstrates the utilization of mobile device among students is high. However, there

are many technical challenges in the use of mobile devices. Among them are difficulty getting teaching materials complete through mobile, access limit and the suitability of devices with applications developed [15]. There found another factor that contributes to the barriers such as limited storage size, the problem with CPU speed & little memory and risk of damage & destruction.

3.3 Cloud computing in public sector

Madini, Alharthi, Abdulrahman, Walters, and Wills in 2016 conducted the study in Saudi Arabia to study the risk factors of safety to organizations using cloud computing [16]. This study has proposed a framework for the successful implementation of cloud computing and focus on security risks in cloud technology. The proposed framework consists of three elements; Social Factors, Cloud Security Risks and Perceived Cloud Security Benefits [16]. Each of the categories contains several of element and factors that construct as an adoption framework. However, this is the study that is still ongoing and the framework needs to be verified.

Another study conducted in 2015 to investigate factors affecting the adoption of cloud computing for e-government implementation in Iraq by Wahsh & Dhillon. They proposed the theoretical model where construct technology and non-technology factor. These factors are adapted from TOE framework and incorporated factors from the Diffusion of Innovation (DOI) framework. The results show that non-technology factors more important than technological factors. Among them is the complexity, compatibility, support of top management, IT and security knowledge [17]. To offer a more holistic view of the essential factor, the sample size would be expanded by involving different groups such as IT experts, citizens, and the person in charge of E-government. Model as shown in Fig. 4.

A study by Elena and Johnson aims to produce a theoretical framework in order to understand and accept the risks of cloud computing service in the United Kingdom government [18]. Only 24 government professionals involved in the subject field by attending the interview session. The results of the studies showed several factors that are categorized according to the hierarchical levels. The most significant factor was; (1) Factors influencing adoption of cloud services; (2) Perceived risks of adopting cloud services; and (3) Perceived security risks [18]. However, the sample size of this study is too small and it would be interesting to assess the statistical implication of the identified variables and the correlation between independent and dependent variables.

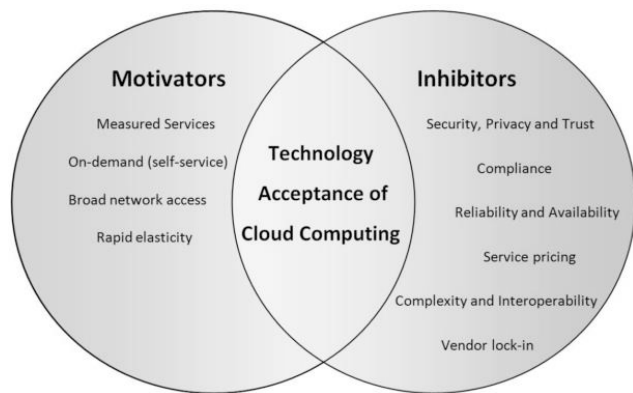


Fig. 3. Two-dimensional research model [10]

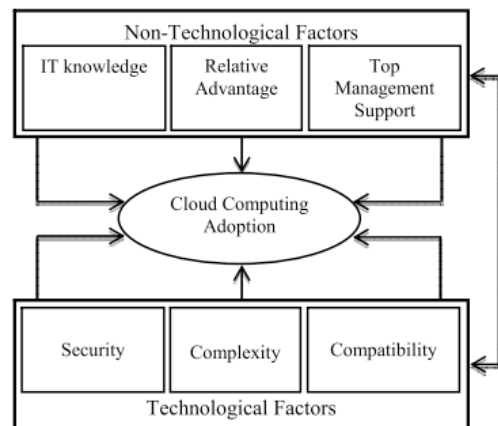


Fig. 4. Structural model for factors of cloud computing adoption [17]

3. Discussion

There are many factors that contribute to the adoption and implementation of cloud computing in various sectors. The benefits derived from the cloud computing are contributing to its implementation. Almost all factors surveyed

have evidenced through various models used as TOE, D&M IS, HOT-fit and SEM model. Factors such as technology and human readiness, organization support, environment and security seen to dominate all the three sectors. While for cost savings factor, they are only seen given emphasis by the health care sector. However, perhaps to cost saving factor was also taken into consideration by the top management. Therefore, this factor was absorbed in the top management support factors which they see cost savings was one of the reasons to implement cloud computing. Effective communication and internet accessibility's factors have been hereditary to the higher education sector. Perhaps because of this sector more focused on information and knowledge access, and communication between students and lecturers. From the literature reviews, lists the factors can be summarized in Table 1. The factors below not just limited to the study mentioned above.

Table 1. Factor in cloud computing implementation

| The factors | Description | Most affected sectors | References |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------|
| Technology Readiness (IT Resources) | Evaluate the readiness of existing technologies in the organization | Health Care, Higher Education, Public Sector | [5], [17], [19], [20] |
| Human Readiness | Assess the readiness of staff to use cloud computing and their level of IT knowledge | Health Care, Higher Education, Public Sector | [4], [8], [19], [21]–[24] |
| Organization & Top Management Support | Assessing the support of top management and the ability of the organization as a whole | Health Care, Higher Education, Public Sector | [8], [18], [19], [25]–[30] |
| Environment | Assess the state of around especially external such as advances in technology, demand and competition | Health Care, Public Services, Public Sector | [1], [7], [8], [19], [24], [31]–[33] |
| Security & Privacy | See the challenges and problems of privacy and risk management during the implementation of cloud computing | Health Care, Higher Education, Public Sector | [2], [3], [14], [15], [18], [20], [25], [34]–[40] |
| Cost Saving | Reduction of operating costs and savings in IT management and any related tasks | Health Care | [7], [13], [19], [25], [28], [29], [36], [38], [39], [41]–[43] |
| Interaction & Feedback | Measure feedback and effective communication of its implementation, especially to get the information fast and quick | Higher Education | [41], [42], [44] |
| Speed of Internet & Accessibility | In view of the speed of the internet and the ability of this technology gives access to users | Higher Education | [13], [15], [20], [25], [27], [45], [46] |

4. Conclusion

This paper reviewed three sectors in implementing cloud computing which are health care industry, higher learning institution and public sector. As shown in Table 1, five key factors dominated all three sectors; technology readiness, human readiness, organization support, environment and, security and privacy. Financial factors and cost savings just became part of the factors to the health care sector. Actually, this off from our initial impression that expects this factor is also a major contributor to all three sectors. Factors of interaction and feedback, and internet access hereditary factors pertinent to the higher education sector. This difference is likely due to the nature business sector concerned and the use of technology among stake holders of the sector.

Generally, there are a lot of research regarding cloud computing was done either in theory or practical. The study is driven by curiosity about the reliability of cloud computing to be the lead in data storage technology. Although many studies found the cloud computing brings more benefits than disadvantages, but the negative effects of the implemented cloud computing should be also being noted especially in the aspect of safety and data privacy. Various models available in cloud computing have enabled the organization to choose a model that fits their needs. Additionally, financial factors [13], [18]–[22], [24], [26], [30], [35], [38], [47]–[50], readiness [1], [5], [7], [12], [15], [17], [20], [22], [24], [25], [27], [30], [45], [51], environment [3], [27], [31], [51], [52], and existing technology [3], [26], [28] will be the focus factor in the implementation of cloud computing in an organization.

A great deal of work done in these areas and variety of research model and analysis technique have been used. There are a few studies can be further improved and the proposed model must be tested to verify it. A few models are complete with the concrete hypotheses [12], [31], [47], [51] would be best to be adopted in a future study with a small modification to suit the background of the study.

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