SOCIETY. INTEGRATION. EDUCATION
Proceedings of the International Scientific Conference. Volume V, May 25th-26th, 2018. 227-237

EXPLORING FACULTY MEMBERS' VIEWS ON ADOPTION OF CLOUD COMPUTING IN EDUCATION

Seren Başaran
Computer Information Systems, Near East University, N. Cyprus via Mersin 10 Turkey

Goran Omer Hama
Computer Information Systems, Near East University, N. Cyprus via Mersin 10 Turkey

Abstract. *The aim of the study is to investigate university faculty members' views towards adoption of cloud computing in higher education. The current status of the faculty on cloud computing usage in education and regional differences were discussed. Strengths, Weaknesses, Opportunities, Threats (SWOT) and Technology, Organization, Environment (TOE) frameworks were integrated. The data was collected through an adopted questionnaire based on these frameworks and demographic information were answered by 300 faculty members from north parts of Cyprus and Iraq. This study is exploratory and causal comparative which descriptive statistics with independent t-test were used to analyse data. The results showed that faculty members agreed mostly on the opportunities which followed by awareness of potential threats and weaknesses and lastly they accept the strengths of adopting cloud computing in education. They are highly in consensus on technological availability followed by organizational aspects and lastly on environment related regulations. Regional difference exists in the sub-dimension of TOE. Faculty members from north part of Cyprus agreed more upon the relative advantage of using cloud computing as compared to their counterparts. The study brought light on the comprehension of faculty members' views from comparative and integrated framework perspectives.*
Keywords: *Cloud computing; cloud computing adoption; higher education; SWOT; TOE.*

Introduction

While cloud computing technology is rapidly growing into an inevitable tool for data exchange and storage at minimized or no cost, cloud computing services have commenced to penetrate educational platforms recently. Higher education administrations and professionals are looking for new tools to handle not only management and communication, but also teaching and learning at the same time. Some higher education institutions are early adopters of such innovations, yet majority are still struggling through the early steps of planning to adopt it.

This study intends to investigate adoption of cloud computing by universities in north parts of Cyprus and Iraq with the involvement of faculty members (full-time academic staff holding at least MSc. degree) to identify the current status

http://dx.doi.org/10.17770/sie2018vol1.3290

and to extract any regional differences. Most importantly, to recognize which extent faculty members from various universities in both regions are using or aware of cloud computing and to obtain knowledge whether there is a great need to recommend its introduction to the educational systems. For this reason, two frameworks were combined namely; SWOT (Strengths, Weaknesses, Opportunities, Threats) and TOE (Technology, Organization, Environment) to identify not only internal but also external capabilities of the cloud computing adoption process. This study is believed to be among few studies that investigated this subject in a comparative perspective. Studies exist investigating adoption of cloud computing in education for Middle East region (Tashkandi & Al-Jabri, 2015a). However, comparing the results of 'early adopters', 'adopters' and 'non-adopters' of cloud computing in education for different regions are still known to be unavailable in the literature. Moreover, up till this date, no study has been identified using the integration of the SWOT and TOE frameworks together to investigate cloud computing adoption in higher education. SWOT framework helps to explore both the internal elements such as; strength and weaknesses and the external elements such as; opportunities and threats of cloud computing and TOE tries to look at the external elements from the technical, organizational and environmental aspects of cloud computing adoption which will help the higher education institutions to firmly understand cloud computing core advantages and limitations at the institutional level.

Overview of the Literature

Higher education institutions (HEI) are seeking innovative tools to implement emerging technologies in education. Accordingly, there is an urgent requirement not only for administrative facilities but also for learning and instructional activities that could be utilized as a part of enhancing correspondence among the parties involved in higher education. Therefore, HEIs are looking for new approaches to maintain such services at moderate or no cost (Ghilic-Micu & Stoica, 2011). Cloud computing remedies these issues by supplying HEIs required services at minimized or almost no expense. Implementing cloud computing in education does not require any expensive IT foundation or environment. Behrend et al. (2010) expressed that cloud computing is picking up ubiquity in educational settings, however the elements that prompt technology adoption in an advanced educational setting were relatively unexplored. The potential of using cloud computing as a medium for cutting edge instruction has been appreciated by various universities (Sultan, 2010). Cloud computing offers institutions the opportunity of concentrating more on teaching and research practices rather than spending time on a complicated IT execution on complex IT plan and programming systems (McCrea, 2009). The educational practices for the use of

cloud computing are varied. One of which is Virginia Virtual Computing Lab (Wyld, 2009). This allowed associations both to hack down IT costs by diminishing the necessities of approving and programming overhauling and to keep up its own specific server ranches, furthermore to improve IT resources for analysis. By including the use of cloud at institution, for instance North Carolina State University fulfilled a liberally reducing of expenses with programming approving and meanwhile to decrease the grounds IT staff from 15 to 3 agents with full working timetable (Wyld, 2009).

The use of cloud computing transforms into a need and are fully embraced recently by few universities. Eventually, a late study seeing using cloud computing as a piece of cutting edge technology shows that universities may even now be found in the time of "early adopters" for business and for regulation purposes (Katz et al., 2010). Adrees et al. (2015) discussed separating the thoughts of cloud computing, models, organizations and architecture with the objective of how to use and associated cloud computing architecture in cutting edge instruction, in developing countries. Researchers communicated that the usage of cloud computing development in cutting edge instruction addresses an authentic open entryway for some countries. Their study arrangements included to perform SWOT examination to choose the impact of the cloud computing use, for instance, SWOT in cutting edge instructional foundations of the selected developing countries, and that from the perspective of directors, teachers and students, to find the effect of characteristics, deficiencies, opportunities and perils when using cloud computing development as a piece of cutting edge instruction. Their study revealed positive results, on versatility and viability and ability to pick up learning.

The adoption of new technologies such as cloud computing is inevitably influenced by the technological, organizational, and environmental contexts in higher education. TOE framework provides suitable guidance with consistent theoretical base and support from extant literature due to its ability to explain inner level adoption processes adequately. However, a variety of other aspects needs to be considered in addition to TOE framework. At this stage, SWOT examination appears to be valuable in fundamental authority for all propelled instruction establishments while considering the transformation of present learning systems to cloud based structures (Odeh et al., 2015). Odeh et al. (2015) categorized elements that influence cloud computing adoption as internal and external respectively. Internal variables consist of strengths as minimized cost, anytime anywhere learning, backup and recovery of learning sources, duration, capability of handling expansion, portability, expanded storage, works on different platform with autonomous location, and weaknesses are; bound to service provider, technical problems and server errors, limited flexibility and control, risks of inaccessibility, inability to check accuracy of data. External variables include opportunities as endorsing interaction and collaboration, supporting knowledge

constructed smart environments, maximum integration and sharing of knowledge, digital learning activities, maximum data storage and accessibility of resources and threats as, security, controlled by vendor, spam messages, administration, regulations, and monitoring problems.

However, SWOT framework does not consider factors at the institutional level. TOE framework which focusses not only technical aspects but also the institutional and environmental factors was primarily used in for cloud computing adoption (Haag & Eckhardt, 2014). Tornatzky and Fleischer (1990) proposed TOE framework to clarify the procedure of advancement with regards to IT adoption. Innovative part of the TOE system alludes to both accessibility and qualities of the advancements. Any inside and outside technology that is important to the institution is a piece of the innovative perspective. TOE serves as classification for variables that encourage or restrain the selection of certain technology (Haag & Eckhardt, 2014). TOE has advantage over Diffusion of Innovation model because of the inclusion of the environmental elements (Alshamaila et al., 2013).

Tashkandi and Al-Jabri (2015a) stated that investigation of cloud computing is a growing area particularly in middle east region. Selection of new developments ought to be gone before by investigation of the additional worth, difficulties and sufficiency from innovative, authoritative and ecological points of view based on TOE framework. Three variables were discovered as the most noteworthy elements; relative advantage, data privacy and complexity. Noteworthy contrasts are in the areas of cloud computing similarity, multifaceted nature, seller lock-in and peer pressure amongst vast and little information was uncovered. Cloud administration supplier ought to address the protection and many-sided quality concerns raised by non-adopters in that study. Numerous aspects should be taken into account in the adoption of cloud computing in higher education sector due to the involvement of multifaceted procedures. Therefore, integrating multiple frameworks provides more functional and exhaustive inspection.

Research Methodology

This study compare and contrast faculty members' views towards cloud computing adoption in higher education. Corresponding research questions are:

1. What are faculty members' views from north parts of Cyprus and Iraq on the current status of cloud computing adoption in higher education?
2. Are there any significant differences in the views of faculty members towards cloud computing adoption in higher education with respect to region (north parts of Cyprus and Iraq)?

a. Are there any significant differences in SWOT dimensions among the views of the faculty members towards cloud computing adoption in higher education with respect to region?
b. Are there any significant differences in TOE dimensions among the views of the faculty members towards cloud computing adoption in higher education with respect to region?

Table 1 **Demographic information of participants**

	North Cyprus		**North Iraq**	
Demographics	***f***	***p %***	***f***	***p %***
Gender				
Male	56	44.8	111	63.4
Female	69	55.2	64	36.6
Total	125	100	175	100
Age				
25-27	38	30.4	35	20.0
28-30	53	42.4	39	22.3
30+	34	27.2	101	57.7
Total	125	100	175	100
Years of working at institution				
Less than 5 years	71	56.8	49	28.0
5-10 years	54	43.2	82	46.9
More than 10 years	0	0	44	25.1
Total	125	100	175	100
Teaching Experience				
Less than 5 years	71	56.8	49	28.0
5-10 years	54	43.2	82	46.9
More than 10 years	0	0	44	25.1
Total	125	100	175	100
Academic Title				
MSc/PhD	71	56.8	49	28.0
Assist/Assoc. Prof	54	43.2	82	46.9
Prof.	0	0	44	25.1
Total	125	100	175	100

The research design was descriptive and causal comparative with the independent variable is region (north parts of Cyprus and Iraq) and dependent variables are dimensions of SWOT and TOE. Average scores for each dimension were calculated and used as dependent variables in the analysis. The questionnaire was adopted from Odeh et al. (2015) and Tashkandi & Al-Jabri (2015a). The questionnaire subject to this research involves 2 sections; demographic information and the two frameworks which are SWOT dimensions drafted from the study of Odeh et al. (2015) and TOE which was drafted from

Tashkandi & Al-Jabri (2015a) where questions are 5 Likert scale ranging from "Strongly Disagree" to "Strongly Agree". Calculated Cronbach's alpha reliability (internal consistency) is 0.75 with the dimension reliabilities range between 0.71 and 0.89 that were considered as acceptable.

The data was collected from total of 300 faculty members of universities in north parts of Cyprus and Iraq. In north Cyprus; 2 public and 3 private universities were chosen for convenience and 125 valid questionnaires were retrieved. In north part of Iraq, 4 public and 1 private universities were chosen for convenience and 175 valid questionnaires were retrieved. Second author contributed to this study by collecting and coding data into SPSS. Descriptive statistics as frequencies and percentages and independent samples t-test to analyse data. Demographic information about participants given in Table 1 above are; male to female ratio is almost equal in north part of Cyprus faculty members whereas male faculty members are dominant in north Iraq. North Cyprus faculty members have younger age ratio as compared to their counterparts. Most of them work at their institution between 5-10 years. North Iraq faculty seems to have more teaching experience than their counterparts. North Cyprus faculty members have titles mostly MSc or PhD whereas north part of Iraq faculty members have professor titles.

Results

Current Status of Views on Cloud Computing Adoption in Education

Likert type responses for each item in the questionnaire were coded as 1 for "Strongly Disagree", 2 for "Disagree", 3 for "Neutral", 4 for "Agree", and 5 for "Strongly Agree". SWOT part (items 1-23) include 4 dimensions (strengths, weaknesses, opportunities and threats) and TOE part (items 24-45) has 3 main dimensions (technology, organization and environment) with 7 sub-dimensions as relative advantage, compatibility, complexity, management support, vendor lock-in, data concern and government regulations.

Table 2 below represents calculated mean scores and mean standard deviations for each dimension and sub-dimension of SWOT and TOE parts respectively. In general, faculty members' responses to SWOT and TOE dimensions regarding the adoption of cloud computing in education range from "agree" to "strongly agree" with some variations in responses across regions and with respect to dimensions/sub-dimensions. Subsequent paragraphs indicate detailed analysis of responses with respect to SWOT and TOE dimensions and sub-dimensions correspondingly.

For SWOT part, faculty members from both regions agreed mostly on the opportunities then threats, weaknesses and lastly on the strengths of adopting cloud computing in education.

Within strengths dimension, faculty members from north part of Cyprus agreed most on the simplicity of implementation whereas faculty members from north part of Iraq agreed most on that cloud computing offers using various devices at any location. They both agreed least on the increased storage capacity of cloud computing.

Within weaknesses dimension, faculty members from north part of Cyprus agreed most on that cloud computing having low level of data verification whereas north part of Iraq faculty members agreed most about depending highly on the service provider. Both faculty members admitted equally that cloud computing in education offers limited control and flexibility.

Within opportunities dimension, both faculty members accept most that cloud computing adoption in education will establish intelligent environments supported with knowledge building. North Cyrus faculty members agreed least on high data storage capacity and availability of resources while north Iraq faculty members agreed least on offering the high level of interactive and collaborative learning.

Within threats dimension, both faculty members agreed most on the data security issues. North Cyprus faculty members agreed least on the customer lock in issues whereas north Iraq faculty members agreed least on the management issues.

For the TOE part, faculty members agreed most on technology dimension then organization and lastly on environment dimension. Organization is the dominating factor in Sarmedy & Simamora (2014) where they conducted TOE analysis for adoption of a specific information system to 45 IT professionals.

Within technology dimension, faculty members from both regions agreed highly on the relative advantage then compatibility, and lastly on the complexity of adopting cloud computing in education.

Within relative advantage sub-dimension, both faculty members agreed highly on that cloud computing provides new educational and research opportunities and agreed least on that cloud computing can shorten information systems deployment time.

Within compatibility sub-dimension, both faculty members agreed most on that cloud computing is compatible with their institutions' operations and agreed least that it is compatible with their institutions' culture and values.

Within complexity sub-dimension, faculty members from north part of Cyprus agreed most on the complexity of the skills required for cloud computing adoption in their institution whereas faculty members from north part of Iraq mostly agreed on using cloud computing services could be frustrating. Both faculty members agreed least on the skills required for using cloud computing is too complex for them.

Within organization dimension, faculty members from north part of Cyprus agreed most on the vendor lock-in, then data concern and agreed least on management support whereas faculty members from north part of Iraq agreed most on data concern, then on management support and lastly on vendor lock-in.

Within management support sub-dimension, both faculty members agreed most on that top management supports the implementation of cloud computing in education and both agreed least on that top management understands the benefits of adopting cloud computing in education.

Within vendor lock-in sub-dimension, both faculty members agreed most on the ability of restriction in cloud computing moving to another service provider. Faculty members from north part of Cyprus agreed least on that cloud computing makes them dependent on the provider services whereas faculty members from north part of Iraq agreed least on that cloud computing authorizes the use of specific IT resources.

Table 2 **Mean and standard deviations for both regions**

	N. Cyprus		**N. Iraq**	
SWOT AND TOE DIMENSIONS	***M***	***S***	***M***	***S***
Strengths (items 1-8)	4.15	0.77	4.16	0.93
Weaknesses (items 9-13)	4.30	0.98	4.30	0.98
Opportunities (items 14-18)	4.56	0.82	4.58	0.78
Threats (items 19-23)	4.50	0.88	4.44	0.94
SWOT (items 1-23)	4.35	0.85	4.34	0.91
Technology Dimension				
Relative Advantage (items 24-27)	4.81	0.45	4.69	0.67
Compatibility (items 28-30)	4.53	0.85	4.64	0.71
Complexity (items 31-33)	4.50	0.84	4.50	0.83
Technology (items 24-33)	4.63	0.69	4.62	0.73
Organization Dimension				
Management Support (items 34-36)	4.50	0.79	4.50	0.80
Vendor Lock-in (items 37-40)	4.55	0.82	4.49	0.84
Data Concern (items 41-43)	4.54	0.85	4.63	0.72
Organization (items 34-43)	4.55	0.82	4.54	0.79
Environment Dimension				
Government Regulations (items 44-45)	4.52	0.81	4.47	0.91
TOE (items 24-45)	4.58	0.76	4.57	0.78

Within data concern sub-dimension, both faculty members highly concerned about the leakage of confidential data and concerned least on storing data in the cloud.

Within environment dimension and government regulations sub-dimension both faculty members agreed most on that laws and regulations are sufficient to protect use of cloud computing and they both agreed less on that laws and regulations facilitate the use of cloud computing.

Differences among Faculty Members' Views on Cloud Computing Adoption

In order to identify any differences among faculty members' views on cloud computing adoption with respect to region, independent samples t-test was employed. Significant difference was found in the relative advantage (RA) dimension among faculty members from north part of Cyprus (M=4.81, S=0.31) and faculty members from north part of Iraq (M=4.69, S=0.50) with t (292.90)= 2.38, p=0.02. While there exist no statistically significant differences among others dimensions. This significant result revealed that, faculty members from north Cyprus believed more that the use of cloud computing brings new educational and research opportunities and perform tasks more quickly with reduced IT expenses. This result is similar with that of Kim et al. (2012) who reported that significant difference occurs amongst UK, USA and South Korea in terms of cloud computing adoption and implementation. Also Hailu (2012) reported from their study with developing countries that there is that significant difference between these countries in terms of cloud computing adoption (Tashkandi & Al-Jabri, 2015a, 2015b).

Conclusion

In order to come up with better solutions for cloud computing adoption, the implications of the study findings could be fruitful for researchers, university administrations and service providers. Using integrated SWOT-TOE framework provides clues to identify the reason behind why some HEIs choose to adopt cloud computing services earlier than others to researchers and administrations. Furthermore, service providers could be informed about the current status and offer education specific solutions to institutions.

In general sense, faculty members from north part of Iraq seem to be slightly more optimistic on the adoption of cloud computing in educational settings. This might resulted from either they less frequently use cloud computing services as compared to faculty members from north part of Cyprus who are younger in mean age and can be considered as generation Y regarded as being more capable consumers of cutting edge technologies like cloud. Interestingly, both parties are

aware of the problems which could be resulted from adopting such innovation. Slight discrepancies detected among the views of the faculty members from both regions thus, for future studies more investigation is required to compare "early adopters" who already fully adopted cloud in educational settings and are already actively using it for a while to "adopters" or "non-adopters" from different regions. More internal and external aspects of other frameworks could be included to understand adoption process from different perspectives. Various communities as students, IT professionals and administrators could also be involved for further investigation of these issues.

References

Adrees, M. S., Omer, M. K. A., & Sheta, O. E (2015). Cloud computing architecture for higher education in the third world countries (Republic of The Sudan as Model*). International Journal of Database Management Systems, 7 (3)*,13-24.

Alshamaila, Y., Papagiannidis, S., & Li, F. (2013). Cloud computing adoption by SMEs in the North East of England. *Journal of Enterprise Information Management, 26 (3)*, 250-275.

Behrend, T., Wiebe, E. N., London, J. E., & Johnson, E. C. (2010). Cloud computing adoption and usage in community colleges. *Behaviour & Information Technology, 30 (2)*, 231-240.

Ghilic-Micu, M. M., & Stoica, M. (2011). Main aspects of the adoption of cloud solutions in managing service-oriented organizations - the case of higher education. *Economy Informatics, 11 (1)*, 27 - 36.

Haag, S., & Eckhardt, A. (2014). Organizational cloud service adoption: A scientometric and content-based literature analysis. *Journal of Business Economics, 84 (3)*, 407-440.

Hailu, A. (2012). *Factors Influencing Cloud-Computing Technology Adoption in Developing Countries*. ProQuest LLC, Ph.D. Dissertation, Capella University.

Katz, R. N., Goldstein, P. J., & Yanosky, R. (2009). Demystifying cloud computing for higher education, *EDUCAUSE Center for Applied Research Bulletin, 19*, 1- 13.

Kim, M., Kim, J., & Lee, H. (2012). Analysis of the Adoption Status of Cloud Computing by Country. *Embedded and Multimedia Computing Technology and Service, 181*, 467-476.

McCrea, B. (2009). IT on Demand: The Pros and Cons of Cloud Computing in Higher Education. Campus Technology. Downloaded from https://campustechnology.com/articles/2009/08/20/it-on-demand-the-pros-and-cons-of-cloud-computing-in-higher-education.aspx

Odeh, M., Warwick, K., & Garcia-Perez, A. (2015). The Impacts of Cloud Computing Adoption at Higher Education Institutions: A SWOT Analysis. *International Journal of Computer Applications, 127 (4)*, 15-21.

Sarmedy, J., & Simamora, B. H. (2014). Cloud Computing Adoption Strategies at PT Taspen Indonesia, Tbk. *CommIT (Communication and Information Technology) Journal, 8 (2)*, 35-43.

Sultan, N. (2010). Cloud computing for education: A new dawn? *International Journal of Information Management, 30 (2)*, 109- 116.

Tashkandi, A., & Al-Jabri, M. I. (2015a). Cloud computing adoption by higher education institutions in Saudi Arabia: an exploratory study. *Cluster Computing, 18 (4)*, 1527-1537.

Tashkandi, A., & Al-Jabri, I. (2015b). Cloud Computing Adoption by Higher Education Institutions in Saudi Arabia: Analysis Based on TOE. *International Conference on Cloud Computing (ICCC)*, Saudi Arabia, 1-8.

Tornatzky, L. G., & Fleischer, M. (1990). *The Processes of Technological Innovation*. Massachusetts: Lexington Books.

Wyld, D. C. (2009). *Moving to the cloud: An introduction to cloud computing in government*. USA: IBM Center for the Business of Government.