

Usage and Factors Affecting Adoption of Cloud Computing in Academic Institutions (A Case Study of Chandigarh)

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Abstract: Cloud Computing Technology is perceived by many as a new asset of Information technology for the IT companies, educational institutions, government sectors, etc. In the ever fast growing economy apart from the challenges faced due to recession, the educational institutes find this a big hurdle as to how to provide necessary Information technology support for Educational activities and research areas. Cloud Computing, the latest buzzword in IT sector, may come to the rescue, as it can provide an easy and inexpensive access to the state of the art IT technology, software and its applications. Cloud computing is a recent concept that is still evolving across the information technology industry and academia. Cloud computing is Internet (cloud) based development and use of computer technology whereby dynamically scalable and often virtualized resources are provided as a service over the Internet. The main aims & Objectives of this research paper is to study the factors which affect the adoption of Cloud Computing Technology in a technical educational institutions, a case study of engineering colleges in Chandigarh (Punjab). Questionnaire was used a data collection tools & technique and the results were analyzed by SPSS & R program for statistical analysis.

Keywords: Saas, PaaS, IaaS

I. INTRODUCTION

Cloud computing is internet based computing where shared servers supply software, infrastructure, and platform devices on a pay-as-you –use basis. All information that a digitized system has to offer is provided as a service in the cloud computing technology. Users can focus more on their core business processes rather than spending time and gaining knowledge on resources wanted to customize their processes. According to NIST Cloud Computing consists of five essential characteristics, three service models and four deployment Models. Five essential characteristics are: on demand self-service, broad network access, resource pooling, and rapid elasticity and optimize resource use. There are four different deployment models of cloud computing. Private cloud, the cloud may be managed by the organization or a third party and may present on premise or off premise. Community cloud, the cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). Public cloud, the cloud infrastructure is made existing to the general public or a large industry group and is owned by an organization advertising cloud services. Hybrid cloud, the cloud infrastructure is a composition of two or more clouds (private, community, or public). Cloud Models can be segmented into Software as a Service (Saas), Platform as a service (PaaS) and Infrastructure as a Service (IaaS). Software as a Service, this is typically where end user applications are delivered on demand over a network on a pay per use basis. The software requires no client installation, just a browser and network connectivity. Platform as a Service is used by software development companies to run their software products. Infrastructure as a Service is a model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. [1], [2]

Cloud computing in education sector:

The benefits of cloud computing are being appreciated by many sectors of business and industry and now are being adopted by education sector also. Cloud computing presents many advantages to e-learning by providing the infrastructure, platform and educational services directly through cloud providers. There are many examples of using cloud computing for education. Virginia virtual computing lab (VCL) uses cloud computing technology and provides students with access to the architectural, geographical, mathematical, research, statistical applications at any time and any location with an Internet broadband connection.

Software in a virtual lab is used more than a software in a physical lab, reducing the peruse cost of each software license and unlike physical computer labs, a virtual lab is available to students 24 hours a day, during every day of the year. [3]

The VCL which began in 2002 by North Carolina State University, with support from IBM, and in 2009 it became available as a free, hardware-agnostic Apache open source project. There are now similar education clouds based on the VCL in California, Georgia, and South Carolina. Cloud computing is an innovative concept, it allows for more than the use of text books and it is a tool to bridge the digital divide and to solve educational problems. For students, cloud computing makes real-time collaboration easy. Online meeting spaces and video chat also make it possible for students to meet and attend classes online. And with assignments which are online and can be accessed anywhere, students can take their learning with them anywhere. All of these

things are made possible through cloud computing and have the potential to transform education as we know it. Cloud computing allows institutions, business sectors and education sectors to access real time information from anywhere in the world in at any time. In the field of education, this is pretty important as it gives the teachers and the learners to continuously update their domain knowledge. Cloud computing allows teachers and learners to access applications and other useful tools free of charge. Cloud computing technology is a new technology for our education sector so it is efficient and also environment friendly. Because cloud computing allows for interconnectivity, students are uncovered to openness. Students are able to experience and feel what is processing in the real world. Educators point to cloud computing as a solution for instructors' obstacles in preparation and development of courses and strengthening curriculum. Which material can be taught and learned using textbooks and chalk boards, it is now gathered and absorbed much more quickly and easily through Internet access, using cloud computing technology in the classroom. This research paper aims at studying the factors which affect the adopting of Cloud computing technology in a Technical education institution, with a particular case study at a renowned public school in Delhi.

II. PROBLEM STATEMENT

The process of purchasing, maintaining, and monitoring Computing assets requires a large investment of financial and manpower resources for any technical institution. An option which centralizes computing assets and can lower the costs and manpower requirements for the organizations is the use of centralized computing assets provided as cloud computing. Currently, many technical institutions are interested in using cloud computing capabilities, but they do not know where to expect changes when choosing for the cloud computing concept.[4] This research attempts to identify the factors taken into consideration by education institutions, when deciding about adoption of cloud computing technology.

III. RESEARCH DESIGN

3.1. RESEARCH QUESTION

The study deals with the factors which affect the adoption of Cloud Computing Technology in educational institutions, a case study on Chandigarh University (Punjab)). Hence, the research question will be: **“What are the Factors Chandigarh University considering observed the adoption of cloud by computing into their operations?”**

3.2. RESEARCH HYPOTHESIS

There is a significant effect between independent variables and Cloud Computing Adoption in Chandigarh University (at level of significance $\alpha=0.05$)

3.3. RESEARCH VARIABLES

The dependent variable: Cloud Computing Adoption

The independent variables:

1. Top Management Support
2. Support and integration with School Services
3. Skills of IT human resources
4. Security effectiveness
5. Cost reduction

3.4. SCOPE AND LIMIT OF RESEARCH

The scope of research is limited to education institution practically in Chandigarh University. The population of study consists of academic and administrative staff.

3.5. RESEARCH METHODOLOGY

The research population includes a study of each of the Executives Directors, Directors, Principal, Deans, Associate Deans, Professor, Associate Professor, Asst. Professor ; Lab Technicians of different departments, Supervisors, Non-Technical Staffs, HR departments , Accounts Department and the other administrative staff at Chandigarh University. The population is selected according to the research variables. Where (350) questionnaires are distributed, (300) are retrieved; as the result, the percentage of responses is (85.00%). After reviewing the literature and interviewing the specialists, the questionnaire is the most appropriate tool for this research. The questionnaire is provided with a cover letter which explains the purpose of this research. The questionnaire is composed of fifth parts as follows:

First Part: General Personal Information, which consists of (6) items.

Second Part: The adoption of Cloud Computing technology, which consists of (9) items.

Third part: Top management Support of the Adoption of cloud computing, which consists of (12) items

Third Part: Skills of IT staff at the institution. It consists of (12) items.

Fourth Part: Security effectiveness in adoption of Cloud Computing. It consists of (12) items.

Fifth Part: Cost Reduction through the Adoption of Cloud Computing. It consists of (12) items

3.6. STATISTICAL ANALYSIS

In order to test the fields of research tool (questionnaire), and paragraphs analysis, parametric tests were used (One sample T test, Independent Samples T-test, Analysis of Variance- ANOVA). Testing paragraphs of each research variable about the average score equal to answer neutrality (degrees approval medium).

Null hypothesis: tests that the average answer degree is equal to 3, which in conversely equal with "Agree" by the Likert scale.

The alternative hypothesis: The average score answer is not equal to 3 If the Sig.>0.05 (Sig. greater than 0.05), according to SPSS and R program results , it cannot reject the null hypothesis, so in this case the average views of respondents on the phenomenon under study does not differ materially from "Agree" which is 3 in Likert scale. On other hand, if the Sig. <0.05 (Sig. less than 0.05), then it can reject the null hypothesis, and accept the alternative hypothesis that the average views of respondents varies materially from the medium approval degree "Agree".

Table 1. Means and Test values for the "The adoption of cloud computing"

No	Paragraph	Mean	Proportional Mean	Test Value	P-value (Sig.)	Rank
1	Cloud Computing technology is an attractive technological option to the Institution.	4.89	87.78	8.68	0.000*	4
2	Cloud Computing technology is an attractive economic option to the Institution.	4.76	88.25	8.02	0.000*	9
3	The Institution Focuses on new IT system projects, which aim to increase the efficiency and quality of services provided for the beneficiaries.	4.95	88.99	9.98	0.000*	3
4	The Institution Focuses on new IT system projects, which aim to maintain competitive advantage.	4.88	87.796	9.03	0.000*	5
5	The Institution has high speed internet lines, and uninterrupted services.	5.09	81.71	9.41	0.000*	1
6	The Institution Focuses on new IT system projects, which aim to increase students satisfaction.	4.81	86.50	9.26	0.000*	6
7	The Institution Focuses on new IT system projects, which aim to increase employees satisfaction.	4.77	85.41	9.03	0.000*	8
8	The Institution Focuses on new IT system projects, which aim to increase data and information security.	5.06	81.43	13.74	0.000*	2
9	The adoption of Cloud Computing technology in IT operations will support the learning process.	4.79	85.77	9.99	0.000*	7
All paragraphs		4.89	87.79	14.11	0.000*	

*The mean is significantly different from 3

Table 2: Means and Test values for “Top management Support of the Adoption of cloud computing”

No	Paragraph	Mean	Proportional Mean	Test Value	P- Value(Sig.)	Rank
1	Top management informed of ongoing developments of Cloud Computing technology and the importance of its use	4.10	71.95	0.85	0.199	7
2	Top management concerns to provide the staff with the needed trainings and skills for any new technology so as to keep up with development.	4.28	75.61	3.89	0.002*	4
3	Top management develops plans which are flexible enough to accommodate any changes required by the adoption of Cloud Computing technology	4.06	71.22	0.69	0.288	8
4	Top management supports the new technologies which serve the learning process, and the Institution students.	4.51	70.24	5.89	0.000*	3
5	Top management seeks to maintain competitive advantage through the adoption of new technologies, and its uses in its Operations	4.52	70.37	5.88	0.000*	2
6	There is a support from top management in IT field to adopt everything new such as Cloud Computing technology.	4.14	72.72	1.43	0.095	6
7	Top Management has a future plan to adopt Cloud Computing, and its uses in IT operations	4.78	75.56	1.89	0.040*	11
8	Top management has plans to get rid of obstacles that hinder the use of any new technology at the Institution such as Cloud Computing technology	4.85	77.04	1.59	0.062	9
9	Top management provides the support and the needed requirements to adopt Cloud Computing technology	4.73	74.50	2.55	0.008*	12
10	The adoption of Cloud Computing technology is included in Strategic Plan for IT Center	4.84	77.88	1.38	0.086	10
11	The administration's decision is wise in the use one of Cloud Computing applications at the Institution.	4.84	76.79	8.97	0.000*	1
12	Top management supports a shift policy in all or some of the IT operations towards Cloud Computing technology.	4.20	74.05	1.99	0.027*	5
	All Paragraphs	3.16	73.19	2.14	0.018*	

*The mean is significantly different from 3

Table 3: Means and Test values for “Skills of IT staff at the institution

No	Paragraph	Mean	Proportional mean	Test value	P-value (Sig.)	Rank
1	Cloud Computing technology helps on the development of IT staff abilities and skills.	4.84	86.69	8.75	0.000*	2
2	Training provided to staff in the field of IT enough, and makes them sophisticated and looks forward to some extent to the latest technology.	4.25	74.79	2.05	0.023*	9
3	Cloud Computing technology helps on the development of the spirit of creativity and innovation.	4.67	81.97	5.75	0.000*	6
4	The Institution provides training programs for employees relating to the new technologies (such as Cloud Computing Technology)	4.78	85.29	-1.92	0.039*	12
5	IT staff realize the importance of the adopting of Cloud Computing at the Institution	4.59	81.65	5.07	0.000*	7
6	IT Management staff continuously on the lookout for new technological developments (such as Cloud Computing Technology)	4.68	82.77	6.52	0.000*	4
7	The staff is sent to scientific missions to take advantage of technological developments surrounding	3.81	76.06	-1.54	0.074	11
8	The staff dissatisfaction and disability to change is one of the challenges that hinder the adoption of any new technology (such as Cloud Computing Technology)	4.46	79.01	3.82	0.000*	8
9	I do not need high effort to inquire or to identify any new technology such as Cloud Computing Technology	4.71	82.21	5.64	0.000*	5
10	Technological developments encourage positive competition among staff to motivate them to serve the general interest of the institution	4.77	84.08	8.10	0.000*	3
11	The Institution holds meetings, lectures and materials for the definition of human resources the importance and the use of Cloud computing	3.99	69.26	-0.31	0.390	10
12	IT staff needs training in the Cloud Computing, especially in the (construction, development, deployment) cloud services	4.97	89.03	12.45	0.000*	1
	All paragraphs	4.48	78.54	6.72	0.000*	

*The mean is significantly different from 3

Table 4: Means and Test values for “Support and integration with Schools Services”

No	Paragraph	Mean	Proportional mean	Test value	P-value (Sig.)	Rank
1	The possibility of moving existing applications and services provided by IT Department at the Institution to the cloud.	4.28	75.61	3.33	0.011*	12
2	Systems, technological services and applications at the Institution are continuously updated to keep pace with technological development	4.65	82.93	7.76	0.000*	7
3	Technological services and applications at the Institution characterized by sufficient flexibility.	4.46	79.27	5.71	0.000*	10
4	The adoption of Cloud Computing technology at the Institution helps to activate new services.	4.85	87.04	11.09	0.000*	4
5	The adoption of Cloud Computing technology at the Institution helps to improve quality of its services.	4.93	88.52	11.59	0.000*	2
6	The adoption of Cloud Computing technology at the Institution helps in distinguishing the Institution in its provided services, which is different from that provided by other universities.	4.91	88.29	9.02	0.000*	3
7	The adoption of Cloud Computing technology at the Institution helps to improve the performance of currently Institution services.	4.83	86.54	9.35	0.000*	5
8	The transfer of e-mail service from the old system to one of Cloud Computing applications (Gmail) easily without suffering.	4.60	82.05	6.72	0.000*	9
9	The facilities of integration services and IT applications with the services provided by Cloud Computing (e.g. Gmail)	4.76	85.12	9.15	0.000*	6
10	Cloud Computing providers offer free services to students, to help them in the learning process by providing disk service to store and share data, e-mail and others.	4.64	82.84	8.75	0.000*	8
11	Cloud Computing provides working environment for students to conduct their scientific experiments that need special devices they cannot provide.	4.38	77.56	5.55	0.000*	11
12	It's possible to access to the services provided in the cloud from anywhere and any device.	4.09	88.71	13.71	0.000*	1
	All paragraphs	4.69	83.90	11.58	0.000*	

*The mean is significantly different from 3

Table 5: Means and Test values for “Security effectiveness”

No	Paragraph	Mean	Proportional mean	Test value	P-value (Sig.)	Rank
1	The data security is the biggest challenges facing the Institution to adopt any new technology	5.43	88.64	17.81	0.000*	1
2	We must know where the data is stored in the Cloud Computing	5.78	75.61	7.42	0.000*	6
3	The strength of data security depends on the strength of service provider in terms of security	5.16	82.96	14.04	0.000*	2
4	It can be considered a contract agreement between the Institution and the service provider as a safety and reliability of the data.	4.75	74.75	8.25	0.000*	8
5	There is confidence in new technologies and the providers of these services (e.g. Google, Microsoft, Amazon,)	4.37	67.25	4.10	0.001*	12
6	The adoption and use of Cloud Computing Technology Lead to develop a plan to protect the security and confidentiality of the information	4.87	77.04	9.69	0.000*	4
7	The confidence increases with companies Cloud Computing service providers in the event of clear agreements related to hacking and electronic security breaches	4.77	75.00	8.63	0.000*	7
8	The Cloud Computing service provided by Google Inc., which is the e-mail service (Gmail) used in the Institution safer than the old system.	4.59	69.88	5.55	0.000*	10
9	The services and applications of Cloud Computing provided by service providers companies (e.g. Google, Amazon, Microsoft,) are difficult to hack and piracy	4.45	68.10	4.88	0.000*	11
10	The cloud for students is safer than traditional methods (flash, the device profile,) in putting their researches, reports and homework .	4.69	72.66	6.41	0.000*	9
11	The things that will help the Institution to overcome fears of safety is not put sensitive data or applications in the cloud	4.79	75.75	8.31	0.000*	5
12	Could be the Institution a hybrid cloud, which consists of a Public Cloud to put non-sensitive and public applications and also from the Private Cloud to maintain the confidentiality and security of data.	4.968	79.01	12.07	0.000*	3
	All paragraphs	4.97	75.37	13.42	0.000*	

*The mean is significantly different from 3

Table 6: Means and Test values for “Cost Reduction”

No	Paragraph	Mean	Proportional mean	Test value	P-value (Sig.)	Rank
1	The Institution focuses on modern IT system projects, which aim to reduce costs.	5.03	88.49	12.03	0.000*	1
2	Transfer the operations and services of Institution to the cloud will reduce costs.	4.88	87.32	12.22	0.000*	4
3	The service of Cloud Computing provided by Google Inc., (e.g. an e-mail service - Gmail) at the Institution is less expensive than the old system.	4.86	86.96	12.07	0.000*	6
4	Many Cloud Computing service providers offer free services to higher education institutions.	4.68	81.65	6.66	0.000*	11
5	There are free services in the cloud help students to communicate with each other, save and share data and others.	4.88	87.04	12.09	0.000*	5
6	The Cloud Computing helps to reduce the expenses that go to buy hardware, servers, software or maintenance.	4.99	89.51	12.25	0.000*	3
7	The most important feature of Cloud Computing is the ability to control costs by use.	4.83	84.57	10.27	0.000*	7
8	The most important feature of Cloud Computing is getting rid of unnecessary costs (place - electricity - air ... etc.).	5.03	81.24	14.56	0.000*	2
9	The Cloud Computing Technology provides innovative Institution services without increasing the cost or the price of the service.	4.78	83.58	9.47	0.000*	8
10	The cloud provides the needs of lab such as (special specifications of high expensive computers, or scientific applications), which it needs to work for a few hours or days continuously to bring out the desired results.	4.77	83.33	9.09	0.000*	9
11	When to adopt Cloud Computing Technology, the cost is greatly reduced and capital expenditure is converted in the IT operations to ongoing expenses	4.65	82.10	8.76	0.000*	10
	All paragraphs	4.89	86.12	16.89	0.000*	

*The mean is significantly different from 3

Stepwise Regression: Table 7 shows the regression coefficients and their P values (sig.). Based on the Standardized coefficients, the significant independent variable is “Support and integration of Institution services” with cloud computing and “top management support of the adoption of cloud computing technology.”

Table 7: The Regression Coefficients

No	Paragraph	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.283	0.370		5.378	0.000
2	Support and Integration of institution services with cloud computing	0.591	0.186	0.512	6.699	0.000
3	Top management support for the adoption of Cloud computing	0.582	0.086	0.435	4.730	0.000

The regression equation is: The adoption of cloud computing in CU = 1.283 +0.591*(Support and Integration of institution services with cloud computing) + 0.582*(Top management support for the adoption of Cloud computing) By using stepwise regression the following results were obtained: R square = 0.772, this implies 77.2% of the variation in the adoption of Cloud computing in CU is governed by “Support and Integration of institution services with cloud computing and Top management support for the adoption of Cloud computing”.

Table 8: ANOVA for Regression

No.	Paragraph	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	25.053	2	8.527	52.705	0.000
2	Residual	21.282	89	0.543		
Total		46.335	91			

Table 8 Shows the Analysis of Variance for the regression model. Sig. = 0.000, so there is a significant relation between the dependent variable “Adoption of Cloud computing in CU ” and independent variables “Support and Integration of Institution services with Cloud Computing” and “Top management support for the adoption of Cloud Computing”.

IV. CONCLUSIONS: Chandigarh University and Engineering Colleges are governed by many factors, from which the main factors are: “Support and Integration of Institution services with Cloud Computing” and “Top management support for the adoption of Cloud Computing”.

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