

Cloud Computing In Higher Education

Pankaj Saraswat¹, and Swapnil Raj²

^{1,2} SOEIT, Sanskriti University, Mathura, Uttar Pradesh, India

Correspondence should be addressed to Pankaj Saraswat; pankajsaraswat.cse@sanskriti.edu.in

Copyright © 2021 Made Pankaj Saraswat et al. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT- Information Technology (IT) plays a critical role in delivering education services to users. To assist students, professors, researchers, and administrative personnel, most education online services at universities have been run on the cloud. These are made possible by the rise of cloud computing in the IT industry. Cloud computing provides Internet-based computer services on demand. The use of cloud computing in higher education, namely tertiary institutions and universities, is discussed in this article. The difficulties of cloud computing in higher education are the subject of the article. It examines studies on adoption difficulties in higher education institutions and provides background on cloud computing. These difficulties are significant because they offer an overview of cloud adoption in higher education. To study the variables that affect users' attitudes and behaviors about utilizing The authors established an integrative references framework based on difficulties in the research and the TAM model for cloud educational solutions in schools' ICT offering.

KEYWORDS- Cloud Computing, Data, Education, Information Technology, TAM model.

I. INTRODUCTION

The use of web technologies to assist virtual learning has risen as a result of the web. systems in recent years. By offering amenities to consumers, the clouds has emerged as the key infrastructure for supporting these applications [1]. Cloud computing is a relatively new concept that allows customers to use computer on and payment assets for what they use. It's extensively utilized in education, with instructors and students storing and sharing data in the cloud. Data was formerly stored on Inside private networks, portable storage disks or memory systems should be kept in a safe location. Data may now be stored on the cloud, allowing for greater flexibility and effective data accessibility. Based to prior research, many aspects of cloud computing have been investigated in the domains of educational, innovation, education information systems, integrated educational information, and schooling institution improvement [2]. Small academic organizations often lacked

the funds and knowledge necessary to properly use informational technologies.

Cloud computing provides possibilities to enhance educational quality by allowing because of the Web's mobility and availability It's possible that this will result in greater flexible and interesting educational situations, as well as better collaboration and communication between students and instructors in different places. Furthermore, cloud-based services may provide saving money and having accessibility to massive technology capacity to consumers and academic institutions [3]. The background of cloud computing concepts, models, and features is presented in this section. Cloud computers is a model for offering supplied and on-demand computational capabilities like networking, server, memory, programs, and services, according to the American Institutes of Standardization and Technologies (NIST). It may be accessed over the Internet and does not need any administrative effort or communication with the clouds services providers. Clouds technology is available in a variety of ways, including software applications, application platforms, and other infrastructure components [4]. Cloud computing, according to NIST includes three service models:

- Software as a Service (SaaS): the whole the software is hosted on the clouds, so customers just see the application(s) the level at which When software is given as a services, it is known to as software as a delivery to as SaaS. This was one of the earliest Cloud service implementations. Software applications are provided as Internet services rather than as software packages to be bought by individual consumers under this approach. Its roots may be App Services Carriers' hosting activities have been discovered, through which some businesses provided Customer Relationship Management software to others. Upgrading and licensing of software resources are not required at the institution. This layers is where the company's e-learning system is implemented [5].
- Platform as a Service (PaaS): Users that wish to create and distribute their own applications may find this useful. This level refers to services that support the whole program developmental cycle, that involves the concept, development, development, staging, installation, operations, and supporting of Internet applications and services via the Internet. In this sense, a PaaS supplier

does not explicitly supply architecture, but rather offers the capabilities that a development need via the use of IaaS services, allowing the programmer indirectly accessibility to IaaS services and, as a consequence, architecture [6].

- Infrastructure as a Service (IaaS): Storage, processing, and networking are all part of a cloud-based architecture. IaaS stands for "hardware as a service," and it encompasses server, networking technologies, memory, and computation, as well as basic characteristics like operational platforms and device resources virtualisation. Hardware assets like space, computing capacity like CPU and RAM, and various IT infrastructures are provided as products to consumers [7]. Instead of investing money on dedicated servers and networking equipment, companies may charge these resources. This layer makes use of the provider's infrastructure to run an e-learning solution.

Higher educational institutes play an important part in the advancement of society. Like companies, universities have become more reliant on informational and communications technologies (ICT). Users of ICT and web solutions must have access to instructional resources. Cloud computing is anticipated to be an intriguing proposition for start-up and tiny academic organizations. The advantages of cloud computing may include, but are not restricted to, greater operational effectiveness and cost savings. For example, the Universities of California (UC) in Berkeley found cloud computing intriguing for use in one of their SaaS application development and deployment courses [4]. The Medicine University of Wisconsin's Bioinformatics and Bioengineering Centre realized that adopting clouds computer in their research provided remarkable processing power. The center has conducted protein study and made it more available to experts from all across the world. [8]

This is mainly owing to the use of Google's cloud-based servers. For financial reasons, several institutions have embraced cloud computing. The School of Electrical Engineering and Computer Science (EECS) at Washington State University has had its funding slashed. Despite the difficult economic environment, the EECS says that cloud computing has allowed it to increase the services it provides to faculty and students. Some colleges and universities are having trouble providing scalable and flexible IT services. For example, there are many difficulties in conventional computer laboratories, such as limited lab hours and seats during peak hours, repairing and maintaining computer labs, commuting to and from university, and the expense of equipping traditional computer labs.

Students, researchers, and academics often seek IT services from the IT Department, whose role is [8]. Students, educators, researchers, and developers may use the IT department's software and hardware resources. However, any of these arrangements may be moved to the cloud using cloud computing [3]. Colleges may concentrate on education and study rather than cumbersome IT installations and software systems thanks to cloud computing (Sultan, 2010). It therefore has the benefit of being more quickly deployable. Cloud computing may aid in the reduction of complexity. A

range of learning tools are available to students. Majors are already using Gmail Documents and Office365, as well as the Microsoft Azure Platforms for computers sciences pupils. Students may use any Internet-capable device to access the instructional materials they need at any time and from anywhere. Lecturers may profit from the cloud since it offers an easier platform for them to create Conferences, courses, seminars, articles, and other aspects of their educational repertoire Scientists might also gain from the advantages of utilizing the internet to do study. most up-to-date technology and hardware while just paying for these services as needed .Developers may design, develop, and test apps on the cloud service provider's infrastructure, then provide those applications to end users through the cloud service provider's data centers system administrators may take use of cloud-based processing, storage, database administration, and other services.

A. Cloud Services in Higher Education

The academic internet computer movement has been adopted by several large IT companies. Apple, Facebook, Facebook, and IBM has all made efforts to help academic organizations get the resources they need. Many of those initiatives are absolutely free. Here is a summary of many of the existing instructional cloud and applications. Due to the abundance of knowledge available online, lecturers no longer need to print teaching material. Learners currently have the option of using the cloud to access homework, class materials, and other resources. Some of the more prominent internet solutions in higher learning are listed below [9].

- Microsoft Education Cloud: Google School Network had been actively expanding education clouds services, including includes Windows Office 365. Schools have access to free mail, a webpage with edit and storage options, instant chat, online conference, and 25 GB of private space. Moreover, students and instructors may create Microsoft Office documents using any browser. The cost of Windows 365 is a drawback. While there is a complimentary option (with a confirmed contract), features like as Office Mobile, office programs for PC or Mac, unrestricted mail space, and voice need a monthly subscription per user. Microsoft's failure to promise 99.9% availability without paying a yearly charge is much more alarming.
- Google Education Cloud: Because it is free, Gmail Programs for Education is 1 of the more extensively used programs (Jay, 2014). It is absolutely free and there are no hidden costs. Just a few of the services include clouds mail, 30Gb of internal space, hosting, text editor, and collaborative features (Google, 2015). Google is Amazon's biggest competitor. Several Google applications, like Email, Hangout, and Planner, are now well when contrasted to Microsoft's Office Suite. The most significant downside is that it requires customers to have (or create) a Google account. Children below the age of 13 are required to get parental authorization.
- Earth Browser: Earth Browser is a virtual globe tool produced by Lunar Software. It's available as a flash

software online or as a download and installation. It is generally used to show meteorological information like temperature, tremors, and other natural disasters. It shows satellite images of the whole earth. Planet Chrome is a browser that works in real time. It shows the object as a four model with information that is continually updated. The planet is shown with a massive quantity of data that is said to be accurate. The object may also be moved and magnified to a definite range.

- Socratica: Socratica is a movie producing firm that specializes in producing high-quality educational videos for people of all ages. Videos were developed that were high-definition, clear, brief, and appealing. Socratica compiles and organizes the best free educational videos into user-friendly categories. Socratica's mission is to arrange educational videos. Users may use this to improve their learning experience.
- Virtual Desktops: A real dashboard is a user interface that enables a user to access the virtual portion of a smartphone's computer setting through programs placed on the user's actual machine. They've also built multiple YouTube channels with material fit for different age groups. In principle, here are two ways to enlarge the virtual area of the screen. Users may create switchable virtual clones of their desktops using the virtual desktops, which are switchable. On modern PCs, this may be performed by utilizing open windows. Another way makes it possible for one imaginary screen to be bigger than the real viewing device. To browse a larger virtual desktop, scrolling/panning into a virtual desktop part is usually employed. Horizons 6 is one of VMware's most well-known solutions. It provides a VDI platform that integrates virtualized and distant computers and applications into an one system that enables clients to view various digital assets from an one unified workspace.
- IBM Clouds School: The IBM Cloud School is a community of academic thought experts that collaborate. It was created with educational institutions in mind, with the goal of cutting costs and increasing services while making data accessible and secure (IBM, 2014). It might also be used to pool resources, improve student performance, and accelerate scientific discoveries. Its goal is to improve administrative efficiency while also reducing management costs. These are just a few instances of ways internet technology might help educational institutions provide services. They're aggressively incorporating cloud technology into their architectures in share public good practice and cooperate with partners on new web technology and concepts.

B. Cloud Computing Challenge in Higher Education

Given the immense advantages which the clouds computer model affords higher educational organizations, clouds computer uptake in further educational organizations is limited, based to a Juniper evaluation. Only 4% of education organizations, based to Gartner, are presently embracing cloud services. Another study found that 12% of respondents were acquainted with clouds computer solutions, whereas %

felt that clouds computer educational services could be implemented in schools [10]. However, moving to the cloud may not be a simple process. Higher education institutions encounter a number of barriers to cloud computing adoption. Researchers have identified a number of variables that influence institutions' choices to embrace cloud computing. The difficulties are detailed in the next section.

- Safety: Clouds computer safety is a big concern in many industries, not just academia organizations, when it comes to adoption. Cloud providers must apply security requirements to ensure the confidence, authenticity, and accessibility (CIA) of educational cloud computing systems. Pupils, lecturers, and administration workers may use identity and verification credentials to verify and validate each other using an username and passwords. are among these needs. Permissions, priorities, and resource ownership are all things that some people need (authorisation). To secure critical institution data such as examinations, grades, and other information from manipulation or unauthorized access, encryption methods should be used. In certain situations, it is also necessary to guarantee non-repudiation, which implies that transactions utilizing time stamps, digital signatures, and confirmation receipts cannot be disputed.
- Privacy: On higher education, privacy guarantees that sensitive data is secured in the cloud against unverified and illegal entry The haze should be used to store student records and researchers' intellectual property. To safeguard personal data privacy, the European Union (EU) has privacy laws prohibiting the transfer of certain kinds of personal data beyond the EU. As a result of this problem, businesses like Amazon and others have been forced to provide storage facilities in the EU. The Clouds technology is being used by several further educational organizations is hampered by regulatory compliance.
- Lock-in: Vendor lock-in occurs when a university or institution uses cloud services from one source and discovers that all of its data and applications are locked-in to that vendor's products, posing risks and substantial expenses to move to another vendor or return to on-premises conventional IT systems.
- Reliability: For cloud users, reliability has also been a problem. Customers of In January 2008, for examples, Salesforce was down for 6 hours, whereas Google's S3: simple store facility and EC2 were also affected 3 hours outage a few days later and an 8-hour outage in July. An outage occurs when the Cloud service is unavailable. The disruption of services at higher education institutions may prevent students from studying and alter the class schedule. It has been said that 100% availability is unattainable.
- Bandwidth: Web connectivity is the foundation of web learning programs. The network bandwidth determines the product effectiveness, which may need network infrastructure expenditure.
- Management: There are distinctions between conventional administration of school and administration of schooling on the clouds. As a result, adopting cloud

computing will provide management difficulties, including how to manage teaching and learning, material and courses, exams, and students.

- Trust: One of the most difficult issues in academics is trust in internet services. A study was performed at Malaysian universities in 2013, including UKM, UTM, UM, and UNITEN. The study's goal was to look at academics' requirements for cloud-based productivity tools in their research processes. Interviews with researchers and postgraduate students were undertaken by the writers. One of the most interesting results was that 89 percent of the academics polled mistrust cloud applications in their study.

II. DISCUSSION

Since it exemplifies the individual individuality in current culture, education is a fundamental human value and important for society. The effective method of teaching provides learners with high-quality education and advanced learning opportunities such as e-learning, as well as high-quality teaching opportunities for tutors. In the area of education, information technology (IT) plays a major role. E-learning and M-learning have become very popular educational technology trends in recent years. E-Learning is a new tool for enhancing the conventional learning system via virtualized remote learning through electronic communication methods, particularly the Internet. A large amount of software and hardware is often required for an E-learning system. Many educational institutions nowadays are unable to afford such expenditures and settings, thus cloud computing is the best option. The Cloud Computing environment is quickly gaining traction as a suitable platform for e-Learning system support. As a consequence, the effect of utilizing cloud computing for e-learning is shown in this article, which includes a cutting-edge educational atmosphere based on both digital and real education settings.

III. CONCLUSION

In comparison to other sectors, cloud computing in higher education is still in its infancy. It will, however, continue to expand over time. With the use of cloud computing, colleges may be able to concentrate more on their primary objectives, which are linked to teaching and learning, while spending less money. On-demand access to different application platforms and a pool of resources is available to students and employees in a timely and cost-effective manner. Cloud computing services are helpful and even required at universities to overcome difficulties and constraints to delivering IT services. Security, privacy, and vendor lock-in are all issues that may stymie cloud computing adoption in education, but there are also internal variables like user acceptability, trust, Internet efficiency, and educational administration responsibilities to consider. This is a continuing study of the obstacles to cloud computing adoption in higher education. According to prior research, empirical investigations of the poor adoption of cloud computing in higher education institutions are lacking. Using

the suggested integrated reference model in this article, we will investigate success criteria for cloud computing adoption in higher education in the future.

REFERENCES

- [1]. de Bruin B, Floridi L. The Ethics of Cloud Computing. *Sci Eng Ethics*. 2017;
- [2]. Ahmed ZA, Jaafar AA, Ghareb MI. The Ability of implementing Cloud Computing in Higher Education - KRG. *Kurdistan J Appl Res*. 2017;
- [3]. Jain A, Pandey US. Role of cloud computing in higher education. *Int J Adv Res Comput Sci Softw Eng*. 2013;
- [4]. Mircea M, Andreescu A. Using Cloud Computing in Higher Education: A Strategy to Improve Agility in the Current Financial Crisis. *Commun IBIMA*. 2011;
- [5]. Pardeshi VH. Cloud Computing for Higher Education Institutes: Architecture, Strategy and Recommendations for Effective Adaptation. *Procedia Econ Financ*. 2014;
- [6]. Rahimah K, Aziati N. The integrated framework of cloud computing implementation in higher education institution: A review of literature. *Advanced Science Letters*. 2017.
- [7]. Sobers Smiles David G, Anbuselvi R. An architecture for Cloud computing in Higher Education. In: *Proceedings of the IEEE International Conference on Soft-Computing and Network Security, ICSNS 2015*. 2015.
- [8]. Singh U, Baheti KP. Role and Service of Cloud Computing for Higher Education System. *Int Res J Eng Technol*. 2017;
- [9]. Chen CK, Almunawar MN. Cloud computing in higher education. In: *Impact of Economic Crisis on Education and the Next-Generation Workforce*. 2015.
- [10]. Van Der Schyff K, Krauss K. Higher Education Cloud Computing in South Africa: Towards Understanding Trust and Adoption issues. *South African Comput J*. 2014;