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# An analysis of factors influencing e-learning with Cloud Adoption in India

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## ABSTRACT

***The potential of e-Learning, while highly promising, suffers from disparities between developed and developing citizens of any country, making information transmission not only difficult but also costly. E-learning comprises of formal training, such as courses, online training, and examinations, chosen learning objects, formalization through document collections, and community creation, all of which may be accomplished through the use of cloud-based software and educational resources. The purpose of this research is to analyze the factors influencing e-learning with cloud adoption in India. It focuses on an e-learning environment kept in a cloud environment to benefit learners throughout the world. The study concluded that cloud computing enables users to be more flexible. Files may be accessed via web-enabled devices such as smartphones, computers, and notebooks. The most important aspect of cloud computing is security. One of the key issues is security and privacy in terms of data storage and security, as well as monitoring service providers' usage of the cloud.***

*Keywords: Cloud adoption, Factors- Flexibility, Scalability, Simplicity, Security and advance technology etc.*

## INTRODUCTION

"E-learning is a technology that uses software applications and virtual learning environments to make conventional education more accessible. The term "E" refers to the electronic mode of learning in E-Learning. E-learning takes several forms, including computer-based training (CBT), internet-based training (IBT), and web-based training (WBT). Information is transported from online sources to end users via network-enabled computers. The data provided is disseminated via audio/video files, satellite TV, the internet, and media discs. These resources contain text, images, animations, and audio/video to convey learning materials to e-Learning users. Many universities and institutes are integrating e-learning for their distant education courses, as well as to improve the capabilities of other professional degree programmes. Cloud computing, mobile learning, communication, and other technologies all contribute to taking e-learning to the next level in the ICT world."[1]

"Because e-learning is not a new technology, it incorporates the most recent technologies to improve its offerings to e-learners. There are several new e-learning approaches available to give educational facilities to e-learners, including a range of new features to improve the functioning and e-learning environment. In these cases, e-learning 2.0 plays an important role in taking e-learning to the next level of internet-based learning. Following the expansion of web 2.0, e-learning has integrated web 2.0 with an amalgam of iPLE (Institutional Learning Ecosystem) to create the new technology known as e-learning 2.0. E-learning 2.0 makes the virtual classroom more efficient than before, with many new features. E-learners access online resources such as blogs, forums, wikis, online organizations, streaming videos, cloud sources, and video/audio

conferencing. Following the growth of e-learning 2.0, several other sub-forms have emerged, including mobile learning, cloud-based e-learning, and blended learning" [2].

## CLOUD COMPUTING

"A networked computer architecture that is driven by efficiencies of scale, in which a pool of abstractly virtualized, and dynamically-scalable, managed computer power, storage, infrastructure, and services are delivered on command to external consumers over the Internet."[3] “Clouds are vast pools of easily useable and accessible virtualized resources (such as hardware, development platforms, and/or services) that may be dynamically adjusted for load balancing (scale) to maximize resource usage. The pool of resources is often used under a pay-per-use model provided by the infrastructure provider through tailored SLAs."[4] A cloud system is made up of three key components: clients, datacenters, and distributed servers. Each piece has a distinct purpose and performs a certain function.

### *CLIENTS*

End users engage with clients to handle cloud-related information. Clients are often divided into three categories:

**Mobile:** Windows Mobile Smartphone, Smart phones like a Blackberry or an iPhone.

**Thin:** They do not do any computations and just show the information. Servers perform all of the work for them. Thin clients have no internal memory. Thin clients are becoming more popular than other types of clients due to their low cost, security, low power consumption, minimal noise, ease of replacement and maintenance, and so on.

**Thick:** These connect to the Internet cloud using different browsers like as Internet Explorer, Mozilla Firefox, and Google Chrome.

### *DATA CENTRE*

A data centre is a group of servers that host various applications. An end user connects to the datacenter and subscribes to several apps. A datacenter may reside at a significant distance from the clients. Virtualization enables many instances of virtual server programs.

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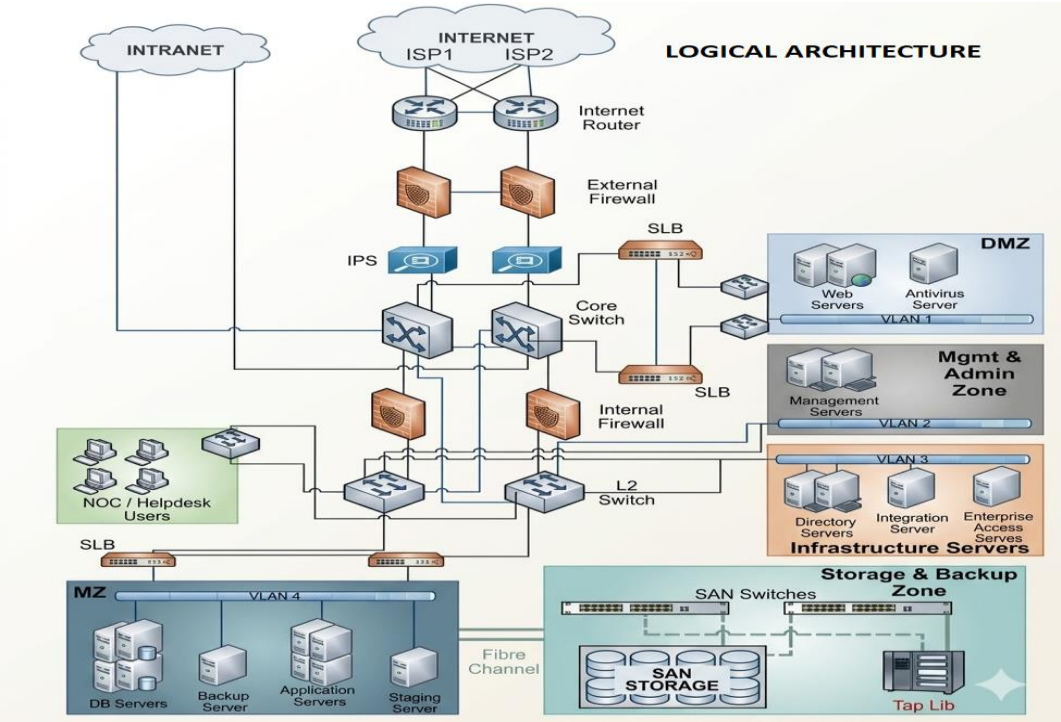


**FIG. 1: DATA CENTRE**

A typical data centre might look like this, with separate zones: the Militarized Zone for database and application servers, and the De-Militarized Zone for web servers. In addition, a Management zone with the management of the company servers would be available for administering the whole infrastructure. Servers might be physical or virtual. Security would be built-in through the use of firewalls and IPS/IDS. The switching would likewise have three tiers: core, distribution, and access. The Cloud-based Application would be hosted in the data centre and accessible to both Intranet and Internet users.

The NKN (National Knowledge Network) design and architecture, which is intended for educational purposes, is similarly based on a three-tier architecture. It enables smooth interoperability and integration across several OEMs (original equipment manufacturers). With the rising number of incidents, highly tough security measures are being devised, implemented, and deployed. Limited access to services is part of the security policy. The Central Operations Control address predicts assaults. Requirements include network-specific, delivery mechanism-specific (clients might be a number of devices such as PCs, PDAs, or other devices), and access mechanism-specific (intranet/Internet). The design will address the overall performance aim of the NKN infrastructure. Distributed servers provide the user the impression that they are utilizing this program from their own workstation.

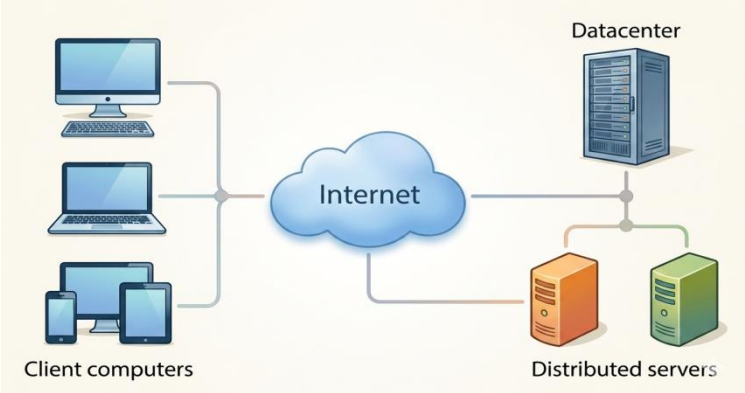


**FIG. 2: CLOUD COMPUTING COMPONENTS**

## TYPES OF CLOUD

Distributed processing has four different mists that alter depending on the techniques of transmission and processing:

***PUBLIC CLOUD-*** Public cloud is a common way for distributed computing in which outside merchants provide IAAS, SAAS, and PAAS. In this manner, the customer may gain access to these administrations on a particularly designated premise via the cloud.

***HYBRID CLOUD-*** The portion is made up of in-house and third-party sources. The private component can only be accessible within the company, while the remaining half is accessed outside.

***PRIVATE CLOUD-*** This is a corporate cloud that supports and owns the company's PAAS, SAAS, and IAAS services. Nonetheless, this cloud may be accessible by other cloud users over a private network.

***COMMUNITY CLOUD-*** This is an external private cloud that is shared by several firms with comparable needs. This cloud is provided by third-party cloud suppliers, yet it is accessible to local businesses.

## CURRENT CLOUD OS PLATFORMS

This portion of the thesis provides a functional overview of prominent computing in the cloud operating systems known as Web OS, or web-based operating systems and architectures.

***WEB OS -*** Today, the web pervades every aspect of our job, linked and limitless. From communications to online office suites, more people are relying on the internet for their daily tasks.


**FIG. 3: EYEOS CLOUD OS**

CLOUDO - Cloudo, formerly known as Xindesk, is an open web-based working platform written in PHP that supports the LAMP programming group. It fully utilizes the program's zone and seamlessly integrates with the iPhone's portable application [5]. This program build OS, created using open advancements, is high in terms of components and simplicity of use.

EYE OS- A web-based operating system that can operate on our own server. With a reasonable number of customization possibilities, it is highly recommended for individuals who need to build up their own Web OS.

GLIDE OS- In the competitive world of cloud computing, Glide OS is yet another operating system. Intel intends to integrate Glide into its ultra-mobile PCs. Glide simplifies cloud computing for PC and mobile platform users by including a plethora of applications.

WINDOWS4ALL- Windows4all is an interactive virtual operating system that uses Microsoft's Silver light technology and has a graphical user interface similar to Vista's desk bar. All Windows fans that need to utilize their beloved operating system on PCs that do not have Windows installed.

GOOGLE CHROME OS- Chrome OS is a Google-designed operating system based on the Linux kernel and featuring the Google Chrome web browser as its primary user interface. Chrome OS primarily supports web apps. It contains a built-in audio player and file management. This is one OS in which both apps and user data are stored on the cloud.


**FIG. 4: WINDOWS4ALL - THE SILVERLIGHT BASED WEB OS**

## LITERATURE REVIEW

Vanitha, P. S., and Alathur, S. [6] illustrate how cloud Infrastructure as a Service (IaaS) enhances the performance of an e-learning system. This study identifies the elements that influence the adoption of a cloud platform for the creation of e-learning services. The e-learning service built on a cloud platform is assessed from a single/multiple data centre perspective. Despite the development of e-learning infrastructure, cloud-based services are often used. The cloud-based e-learning simulation environment is constructed with the CloudAnalyst tool. The cloud's efficiency is evaluated using e-learning housed in both a single and several data centres. The datacenter's service time and total response time are assessed using CloudAnalyst. The infrastructural costs for both concepts have also been calculated.

Khan, M. A., and Salah, K. [7] give a review of cloud usage targeted at equipping students with practical skills in an educational setting. They propose a taxonomy of cloud-based e-learning usage, as well as an analysis of existing important contributions on the topic. They also conduct a comparative study of literature-based frameworks and models, as well as a comparative evaluation of e-learning implementations. The future obstacles and key concerns encountered while implementing cloud technology for e-learning are also examined, along with suggestions for potential remedies.

Bhardwaj, A. K., et al. [8] investigate the parameters influencing CC adoption (CCA) by HEIs in India. The data show that competitive advantage (CA), technological compatibility (TC), technology readiness (TR), senior leadership support, security concerns, government backing, and vendor support are all key contributing variables to CCA by Indian PUs. The report believes that, while the remaining elements have a beneficial impact on PUs' desire to implement CCA, security concerns are a key cause for these universities' reluctance to embrace CC. The findings revealed the use of an integrated TAM-TOE-DOI paradigm to examine the determinants of CCA in Indian PU. Furthermore, the study provided valuable insights into Indian PUs' effective CCA, which will assist eLearning and telecommuting during COVID-19 or a similar epidemic.

Gupta, N., et al. [9] explore end users' perspectives on the use of cloud-based e-learning platforms by Indian colleges and institutions, namely Chandigarh and Punjab. E-learning creates a highly dependable and effective teaching-learning environment. A cloud-based e-learning

system improves the quality and effectiveness of education, particularly in higher education. Overall, cloud computing has a significant influence on society and everyone's daily lives.

Madni, S. H. H., et al., [10] investigate the variables impacting IoT acceptance for E-Learning use in higher education institutions. Furthermore, an adoption model for IoT-based E-Learning in poor nations is given, along with recommendations for increasing IoT use for E-Learning in higher education institutions. The IoT-based E-Learning paradigm divides these influencing elements into four categories: person, administrative, environmental, and technology. These findings, according to the researcher, will demonstrate that national culture has a substantial impact on human, organizational, technical, and environmental behaviour towards the use of new technology in emerging nations.

AlAjmi, Q. [11] established a framework based on several variables, including technology evaluation, readiness evaluation, and information culture characteristics. The final model was developed based on the data, which showed that criteria such as fit, viability, and information culture had a significant impact on HEIs' decisions to implement CBEL in Oman. The generated model revealed that 68.2% of the necessary factors for CBEL adoption were addressed, and that employing this model might result in a 56.1% improvement in academic service quality.

Eljak, H. et al. [12] examine e-learning and computing in the cloud integration to better understand synergies and possible effect. The study tackles two key research questions: the impact of e-learning on architecture, software, performance, security, hardware, network, and virtual elements, as well as an evaluation of cloud computing services and models such as SaaS, PaaS, IaaS, and SOA. The study's goal is to give insights into how e-learning is implemented in a cloud computing context. The report looks at e-learning integration in cloud computing, pointing up constraints in hybrid and private clouds, specialized infrastructures and a gap in platform and infrastructure options.

Ali, J. et al. [13] conducted a thorough review of previous research to identify crucial elements involved in the IoT adoption process. Their research reveals that accessibility, accessibility, us technical assistance, and individual competencies all have a significant impact on the pace of IoT adoption. This research concludes with real recommendations to improve IoT integration inside Saudi Arabian HEIs, providing significant insights for government bodies, policy architects, and HEIs to solve the challenges related with IoT deployment in the higher education sector.

Kotiyal, P., and Awasthi, M. [14] demonstrate some of the benefits that cloud computing might offer to higher education, examine some of the major challenges that academics may face as a result of its implementation, and propose some early steps toward its acceptance while reducing the dangers. Cloud computing-based tools and services can help to improve educational delivery in our situation. The research used a survey strategy as well as a descriptive method. The data was analyzed with the PLS-SEM tool. In this context, a hybrid architecture was implemented to assist institutions in adopting cloud computing and overcoming the stated difficulties.

Gosavi, C., et al. [15] conduct a thorough examination of numerous theories, models, and frameworks to give insightful insights on the variables impacting the use of e-learning technologies in the classroom. A wide range of concepts, methods, and frameworks can impact

the process of implementing e-learning in educational settings. These ideas explain the elements that influence the acceptability and use of e-learning technologies in educational environments.

Neelakantan, P., and Nikhith, G. S. [16] investigate the process of adopting and implementing the Cloud-Based E-Learning (CBEL) model, stressing the influence of customer innovativeness as a behavioural parameter. The findings show the link between population characteristics (gender, age, education, and experience) and technology adoption, providing significant insights for educators, policymakers, and service providers in India seeking to promote E-Learning engagement and satisfaction. This study provides a unique insight of the factors influencing E Learning uptake, enabling innovation-focused activities to improve E-Learning in India.

Kumar, S., and Gandhi, P. [17] investigate the integration of the Felder-Silverman Learning Style Model (FSLSM) with cloud-based customized e-learning systems, focusing on the models, obstacles, and best practices for their implementation. The study investigates several cloud architectural models, including hybrid and multi-cloud systems, that enable the effective delivery of FSLSM-based content.

Lakshmi, Y. V., and Majid, I. [18] investigate the factors that influence academic staff preparation for e-learning in higher education institutions (HEIs) in Jammu and Kashmir, India. By combining features from current e-learning readiness (ELR) models, the researchers identified the most important aspects and suggested an indigenous reflective measuring approach for assessing academic staff ELR. These findings provide practical insights that may be applied to other locations dealing with comparable restrictions in improving awareness among academic staff about the essential aspects that contribute to their preparation for e-learning.

## RESEARCH METHODOLOGY

Surveys are used to obtain demographic information as well as user feedback. An online survey, often known as a web form, is a questionnaire used to record audience responses over the internet. A database is utilized to store the answer, while statistical software provides insights. The online survey is a cost-effective technique to run a survey. Large volumes of data may be easily gathered without paying interviewers. There is no charge for paper or mail. To gather data, we created two online questionnaires on cloud computing and e-Learning. Security, trust, cost, and challenges associated with cloud computing implementation are the main concerns. We utilized Google forms (documents) to conduct online surveys. With several questions, data is gathered, processed, and structured in Excel/Html/Summary result sheet, making survey findings easy to evaluate.

## ANALYSIS AND DISCUSSION

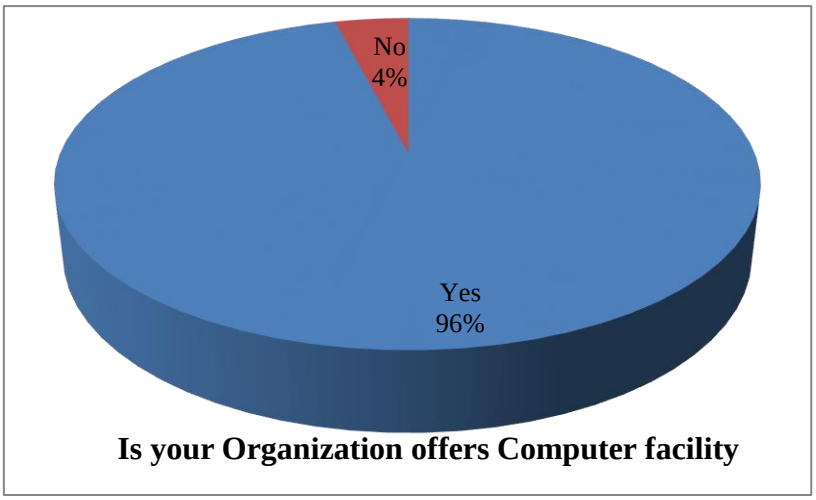


**FIG. 5: % OF RESPONDENTS ON "IS YOUR ORGANIZATION OFFERS COMPUTER FACILITY"**

96.00% of pupils say that organization offers computer facility, this is the basic feature needed for cloud computing.

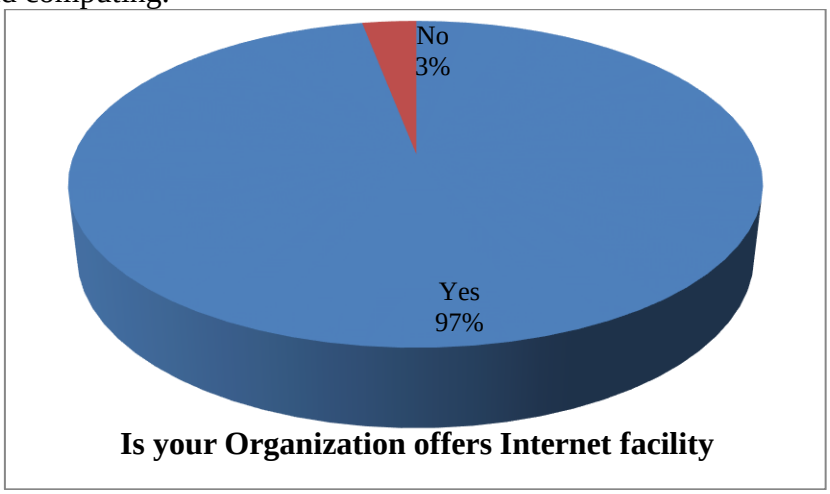


**FIG. 6: % OF RESPONDENTS ON "IS YOUR ORGANIZATION OFFERS INTERNET FACILITY"**

97.00% of students report that their organization provides Internet access. This clearly shows that virtually all organizations have the infrastructure in place to implement cloud computing.

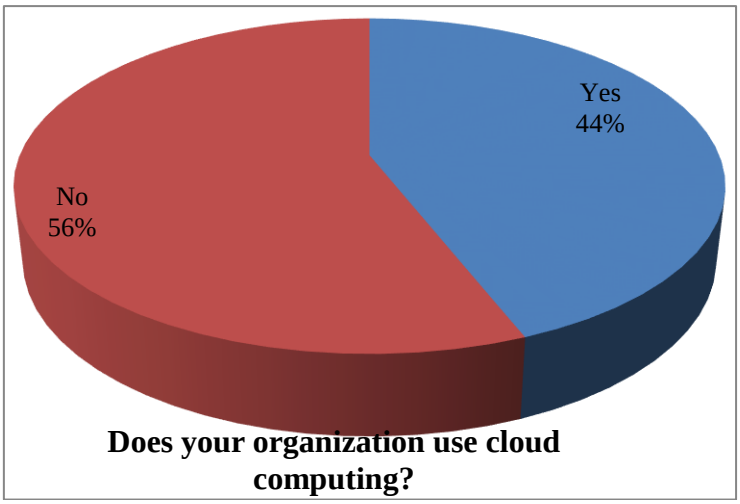


**FIG. 7: % OF RESPONDENTS ON "DOES YOUR ORGANIZATION USE CLOUD COMPUTING?"**

44.00% of respondents agrees that their organization use cloud computing. Whereas 56.00% says that their organizations does not use cloud computing.

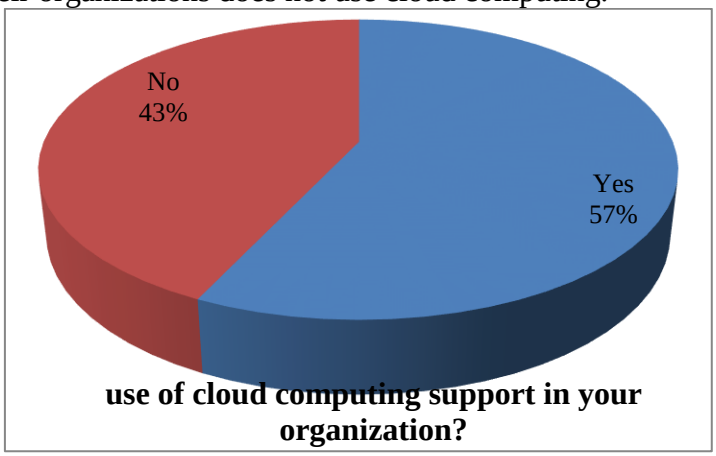


**FIG. 8: % OF RESPONDENTS ON "USE OF CLOUD COMPUTING SUPPORT IN YOUR ORGANIZATION?**

57.00% respondents are planning to use cloud computing support in their organization, and, 43.00% says no to this question.

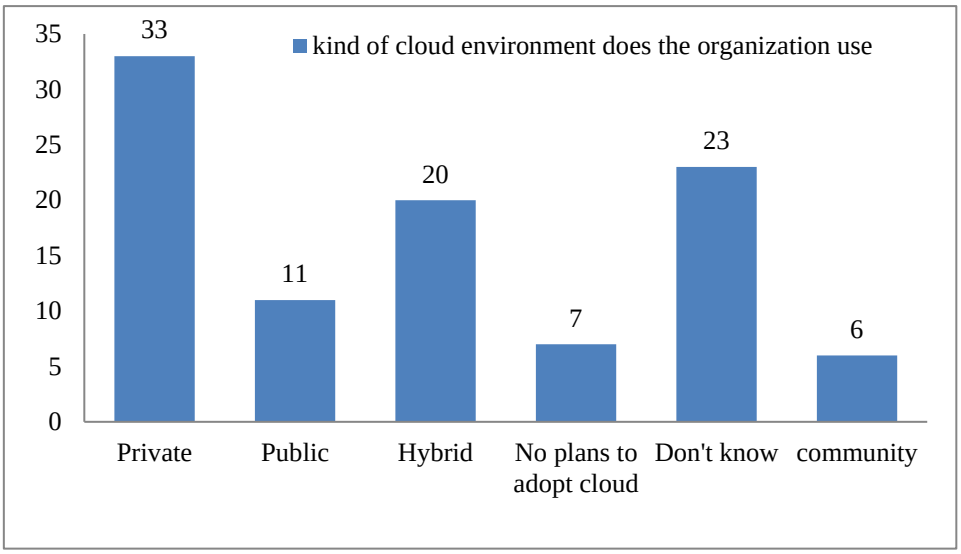


**FIG. 9: % OF RESPONDENTS ON "KIND OF CLOUD ENVIRONMENT DOES THE ORGANIZATION USE?"**

When asked what form of cloud environment they now use or want to utilize, 33.00% said private cloud, 20.00% said hybrid cloud, 11.00% said public cloud, and 6.00% said community cloud. In contrast, 23.00% are unaware of the sort of cloud they are utilizing, and 7.00% have no ambitions to utilize cloud.

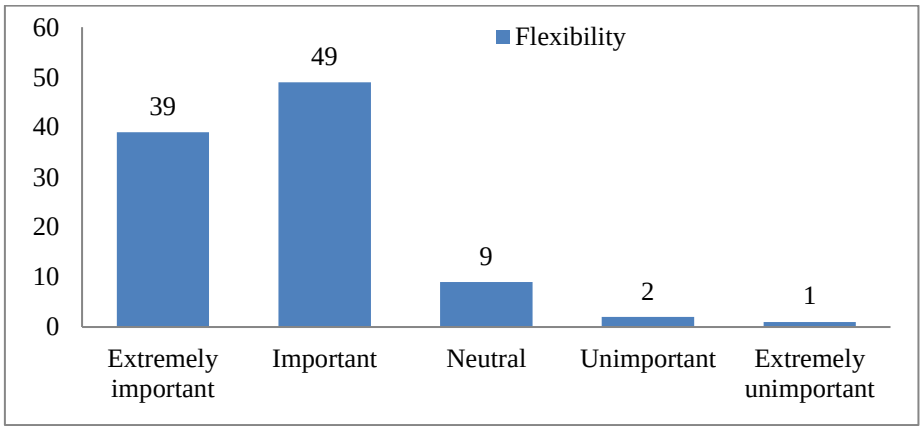


**FIG. 10: % OF RESPONDENTS ON "FLEXIBILITY"**

Cloud computing enables users to be more flexible. Files may be accessed via web-enabled devices such as smartphones, computers, and notebooks. 88.00% of respondents believe that flexibility is an essential (49.00%) or extremely important (39.00%) factor. 9.00% feel this aspect is neither significant nor unimportant, while 3.0% say it is unimportant.

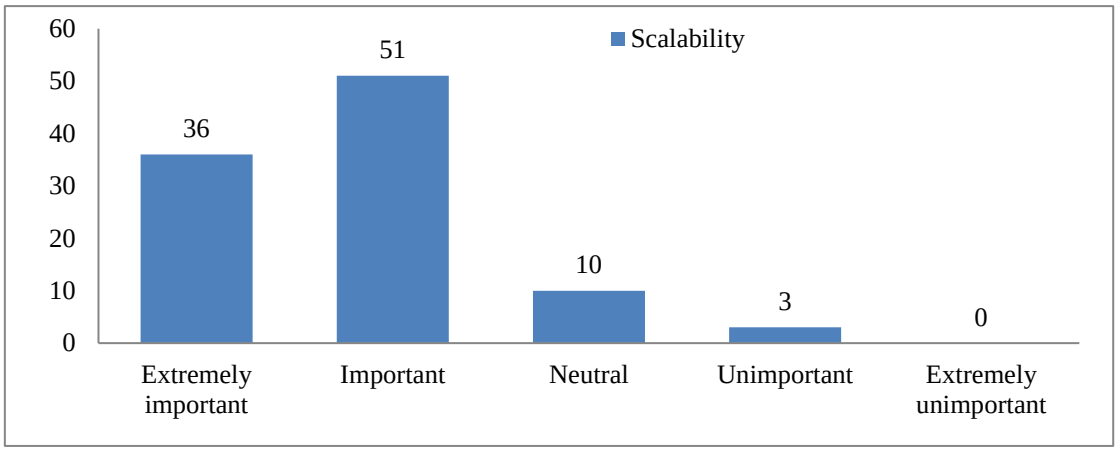


**FIG. 11: % OF RESPONDENTS ON "SCALABILITY"**

Cloud computing enables businesses to effortlessly scale up or down their IT requirements as needed. Scalability is considered significant (51.00%) or extremely important (36.00%) by 88% of respondents. 10% feel this aspect is neither significant nor unimportant, while 3% say it is unimportant.

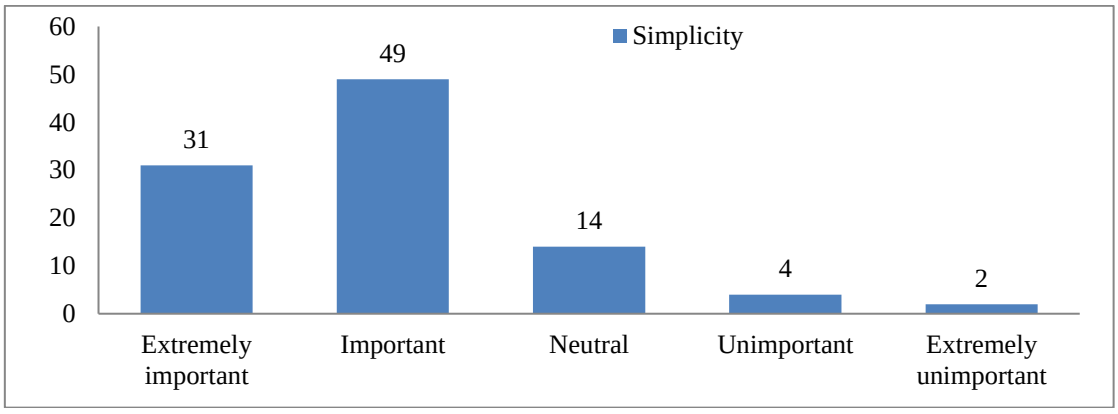


**FIG. 12: % OF RESPONDENTS ON "SIMPLICITY"**

Cloud computing offers ease for both end users and developers by delivering a user-friendly development environment and interface. 80.00% of students feel that simplicity is an essential (49.00%) or extremely significant (31.0%) aspect in cloud computing adoption. 14.00% feel this aspect is neither significant nor unimportant, while 6.00% say it is unimportant.

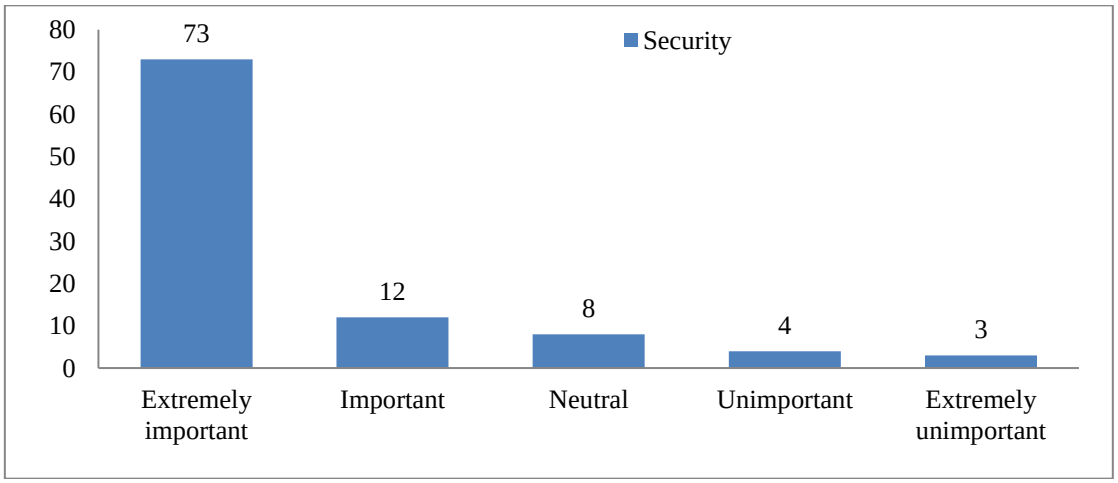

**FIG. 13: % OF RESPONDENTS ON "SECURITY"**

The most important aspect of cloud computing is security. One of the key issues is security and privacy in terms of data storage and security, as well as monitoring service providers' usage of the cloud. The security protocols between the company and the cloud must be strong. 85.00% of students believe security is an important (12.00%) or extremely essential (73.00%) aspect in cloud computing adoption. 8.00% feel this aspect is neither significant nor unimportant, while 7.00% say it is unimportant.

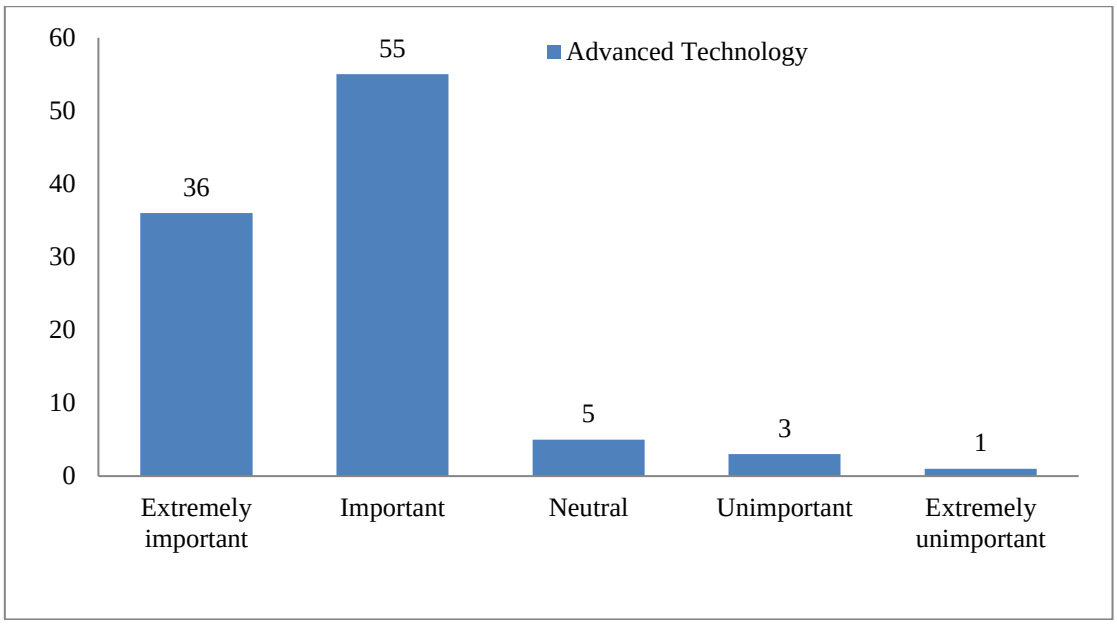


**FIG. 14: % OF RESPONDENTS ON "ADVANCED TECHNOLOGY"**

91.00% of respondents believe improved technology is a significant (55.00%) or highly important (36.00%) aspect in cloud computing adoption. 5.00% feel this aspect is neither significant nor unimportant, while 4.00% say it is unimportant.

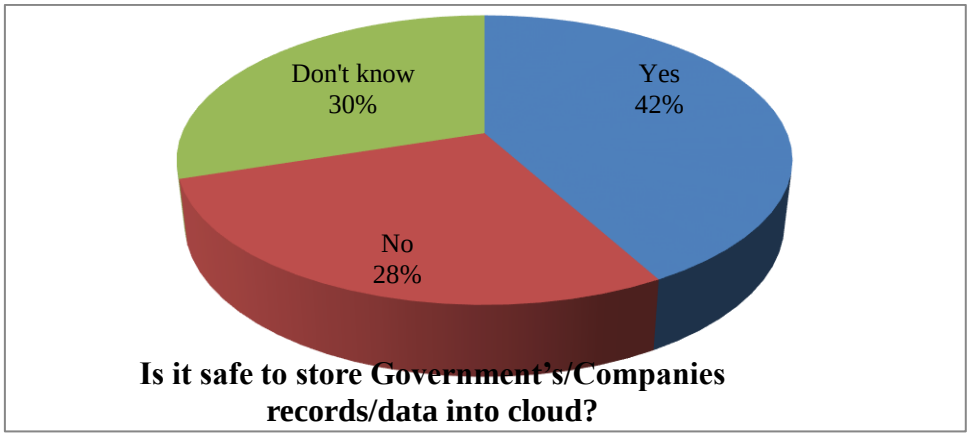


**FIG. 15: % OF RESPONDENTS ON "IS IT SAFE TO STORE COMPANIES DATA INTO CLOUD?"**

42.00% of respondents believe that it is safe to put government/company records/data on the cloud. 28.00% of respondents said no, while 30.00% were unaware of this aspect.

## CONCLUSION

Cloud computing cannot handle the bulk of IT difficulties; nevertheless, it may be a solution to some of them. Each learning unit should do its own due diligence to determine if the benefits of distributed computing outweigh the risks in light of its unique environment and institutional settings. Infosys Corporation analysts recommend that cloud choosing should be approached in stages. These include evaluation, approval, preparedness, and execution. A user can access information on a mobile device or a desktop computer using a simple web browser or a specialized application. Even with existing hardware and software restrictions, mobile devices can enable multimedia-based apps. Currently, multimedia-based applications are severely limited owing to processing power and memory limits. Because the data processing takes place on the server side, the usage of mobile devices for learning is rapidly increasing. Results of this study is shows that the cloud computing enables users to be more flexible. Files may be accessed via web-enabled devices such as smartphones, computers, and notebooks. Cloud computing enables businesses to effortlessly scale up or down their IT requirements as needed. Cloud computing offers ease for both end users and developers by delivering a user-friendly development environment and interface. The most important aspect of cloud computing is security. One of the key issues is security and privacy in terms of data storage and security, as well as monitoring service providers' usage of the cloud.

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