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Adoption of Cloud Computing by State Universities of Khordha District, Odisha – Benefit, Challenges & Issues

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Abstract: *Cloud computing is the talk of today. Cloud computing can be considered as the set of hardware, software & storage which is served over the internet from shared data centres with certain scale of economy. Companies now-a-days can use cloud computing effectively. For example instead of spending lakhs of rupees for purchasing computers, softwares etc, they can outsource computing requirement from remote cloud and pay as per their use. For example Netflix use cloud computing to optimize its profit at a large scale. As per David Linthicum, author “cloud computing and SOA convergence in your enterprise :step-by- step Guide “ cloud computing are much better and more cost effective. My main aim is to provide a study on adoption of cloud computing by state universities of Khordha District, Odisha-benefit, challenges and issues. The data collected are primary and secondary data. The conclusion what I drawn is that, the study result will benefit lots of individual and all state universities of Khordha District and as well as all the universities of Odisha in a cost effectiveness to adopt cloud computing at a large.*

Keyword: *Cloud computing, universities of Odisha, saas, iaas, paas, online learning, benefits, challenges & issues. E-learning, E-library, Virtual library, e-learning, digital library.*

I. INTRODUCTION

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models[1]. Cloud computing is a type of computing that relies on sharing computing resources rather than having local services on personal devices to handle applications. In cloud computing, the word cloud is used as a metaphor for the internet. So the phrase Cloud means a type of internet based computing, where different services, storages and applications are delivered to an organization's computers and devices through the internet [2].

The term cloud computing is a very peculiar term from its business perspective. Its services can be classified as IAAS(Infrastructure as a service), SAAs(Software as a service), PAAS(Platform as a service) and FAAS(Function as a service). These are sometime called as cloud computing stack. Cloud computing is an application based software that stores data on remote server. Then the user can access data through internet as per their requirement via their cloud service provider like amazon, google etc.

The main objective of this paper to prepare a thorough study of adoption of cloud computing to maximum level by all the state universities of khordha district of odisha, which are facing severe IT issues for delivering their maximum efficiency from IT perspective.

A. Statement of The Problem

Total number of state universities in Khordha district of Odisha is 5 as per UGC Website, whose names are as follow

- 1) International Institute of Information Technology (IIIT)
- 2) Orissa University Of Agriculture & Technology
- 3) Rama Devi Women's University
- 4) Utkal University
- 5) Utkal University of Culture

Although cloud computing technology is quite popular among different age group of users as well as by different universities and organizations of world and India. But it is still not popular among the state universities of khordha district of Odisha. Although Utkal University maintain their digital library on UGC Inflight support and IIT developed Virtual Labs and Cloud based Labs for

many IT oriented subjects with a Servers to support variety of services[,but other state universities in Khordha are not at all use cloud computing for improving their IT efficiency to maximum level.

IIIT Bhubaneswar owes its origins to the initiative of the Government Odisha. It is a result of the desire of the Government to establish a world class institute of Information Technology in the state. The Institute has been registered as a society in Nov 2006. In January 2014, the Institute is converted to a University by the Government of Odisha. The Institute has developed Virtual Labs and Cloud based Labs for many IT oriented subjects with a Servers to support variety of services[12]. So IIIT University as a premier information technology university can support all these other state public as well private university inside the state of Odisha to adopt cloud computing technology to increase their IT efficiency from all perspective at a large.

Odisha University Of Agriculture And Technology(OUAT) is the second oldest university of after Utkal University and established in the year 1961. Although its basic focus is on subjects like agriculture, horticulture and veterinary ,but it has not yet provided cloud based ERP solutions in academics as well as e-learning and digital library facility on 24x7 basis

Rama Devi Women's University is the first women public state university of odisha which was established on 30th may, 2015. It has set up an e-learning laboratory to improve the academic and administrative facilities of the university[6], but still they are not able to implement ERP solution for academics which is the need of hour.

Utkal University is the oldest and first university of Odisha established in 1943. At present the university has 27 Post graduate teaching and research department as well as runs 15 sponsored courses and three UGC sponsored innovative programmes besides two constitutions institution : directorate of distance and continuing education and university law college at Vani Vihar. The university now has jurisdiction over nine districts and caters for higher education need for a population of more than 1.5 crore and it has 371 affiliated colleges and its main campus at Vani Vihar is spread in more than 400 acre of land[7]. Still it has not implemented ERP for its academic activities and full online support to its huge amount of students .

Utkal University Of Culture was founded on June, 1999 as separate university from Utkal University. Its new campus is located in Madanpur , Khordha which is a lush green campus with all modern facilities , still it has not implemented ERP as well as E-Learning and digital library for academic activities.

Due to rapid digitalization ,all the universities across the globe are focussing on providing E-learning platform as well as E-library(Virtual library) facilities to their students as well faculty and other staffs. For this purpose adoption of cloud computing is mandatory for all the state universities of Khordha district of Odisha.

B. Consideration

The main consideration for adoption of cloud computing by state universities of Khordha District, Odisha is to provide E-learning platform & E-library(Virtual library) facility as well as ERP and other online facilities by economical IT budget which can be only possible ,if only all of them adopt SAAS or IAAS or PAAS service of cloud computing or private cloud. Universities take advantage of available cloud-based applications which allow their staff and students to perform their academic tasks. By providing the necessary IT infrastructure and other relevant educational services, cloud computing offers many benefits to educational institutes such as lower operation costs, personal and virtual computing resources and centralized storage for data access monitoring(Pocitilu, 2009) [8].

C. Benefit of Cloud Computing

- 1) It is accessible to all the users without any restriction
- 2) Adoption of cloud computing for application is very cost-efficient(Source-www.educeba.com)
- 3) It leasts the possibility of access failure due to non-dependency on a single machine.
- 4) Cloud provide independence of machine access. URL will give you access to your infrastructure all the time.

II. REVIEW OF LITREATURE

Before I begin my study for this purpose ,I found the literature review about what cloud computing is?. The answer what I found is below

"I realized that what I was standing in was prototype of a new kind of power plant- a computing power plant that would come to power our information age the way great electric plants powered the industrial age." Nicolas Carr, the Big Switch[3]. Basically cloud computing is a boon to organizations, companies and institutions to store their huge amount of data as well as carrying their online activities through the cloud service provider in a secure manner economically.

The first building block of cloud computing is infrastructure where the cloud will be implemented. It is a wrong assumption that environment should be virtualized but cloud is a way to request resource in on-demand way

As per NIST the five essential characteristics of cloud computing are-

- 1) On demand self-service
- 2) Broad network access
- 3) Resource pooling
- 4) Rapid elasticity
- 5) Measured service



Fig-1:Types of cloud

A. Types of Cloud

According to NIST (National Institute of Standards and Technology) the following definitions are used for deployment models (National Institute of Standards and Technology, 2011, p. 3)[1] :

- i. Private cloud. The cloud infrastructure is solely operated for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.
- ii. 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). It may be managed by the organizations or a third party and may exist on premise or off premise.
- iii. Public cloud. The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.
- iv. Hybrid cloud. The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)[5].

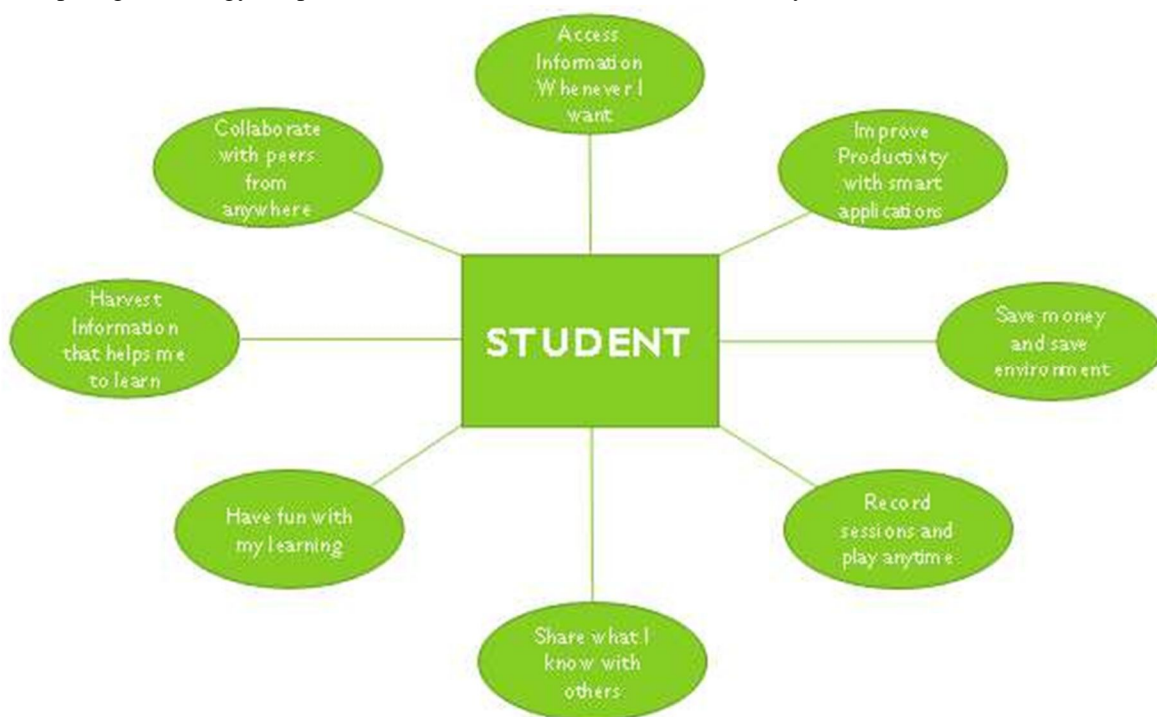
As kumar [9] studied that Cloud computing use in Higher Education is still a debatable issue with several challenges in addition to benefits. Cloud Computing depends on the different types of deployment models used. The public cloud is a group of computer and service of computer network according to Cloud Computing Model, where the service provider makes resources which is accessible to the public for use over the internet. The private cloud is a platform which works within a company's firewall and is managed by their own IT department.

Though the private Cloud has the same features as the public Cloud Computing systems, its main aim is to remove the security issues pertaining to the public cloud. A hybrid cloud is a cloud computing environment where the organization manages its own personal and sensitive data and uses the public cloud for certain applications like email. Hence the selection of a cloud deployment model is one of the major decision of higher education IT managers. Universities may have their own private cloud for their own consumption, and even offer hosting services for other universities to generate revenue. For a smaller college it will be more beneficial to simply adopt applications and services thus enabling the college to skip a whole generation of academic computing and reducing the costly and debilitating challenges.

B. Benefits of cloud Computing to Universities

One of the main benefits of cloud technology to universities is the savings – in both time and money – that can be made. Cloud technology can eliminate the need for specialised software and hardware on individual terminals. This then allows for a greater degree of flexibility in regards to both access and scale. Individuals are able to access information stored on ‘the cloud’ from wherever they have access to the internet, thus allowing professors to receive submissions while they’re out of the office, and for students to be able to access lecture notes and emails during term breaks. Cloud-based technology also allows a university to scale back its accessible resources – when it finds it no longer needs them – in order to reduce costs. Cloud-based subscriptions, meanwhile, can be increased and decreased easily without the need to purchase or sell any additional equipment, such as external hard drives[10]. Cloud system leads to more concentrate on research and teaching system rather than other IT software. (McCERA, 2010).

Universities worldwide have been quick to adopt cloud technology and real benefits have been shown to both students and staff in a relatively short space of time. The question now is how long it will take for all state universities of Khordha District universities adopt cloud computing technology to optimize their It based use in an economical way



Source:<http://blogs.technet.com/b/ptsblog/archive/2011/08/07/mobile-computing-in-education.aspx>

As per Amazon cloud service, whether your focus is teaching and learning, better management of your university’s operations, or access to high-performance computing for research projects, AWS has a solution. Instructors, students, researchers, IT staff, and administrators can quickly and affordably access compute, storage, and application services in the classroom, research lab, data centre, or anywhere on campus[11]

Lancaster University is one of the first UK universities to offer a voice and chatbot interface, which covers a wide range of interactions relating to student life, academic studies and other academic activities and more. Designed to have a human-like personality and powered by AWS, The Ask LU Alexa skill is embedded in the University’s mobile app and web portal. It allows students to ask almost any question about their university experience and covers topics as diverse as study skills, welfare problems, social life and academic progression. Students can already ask Alexa the below questions:

Academic

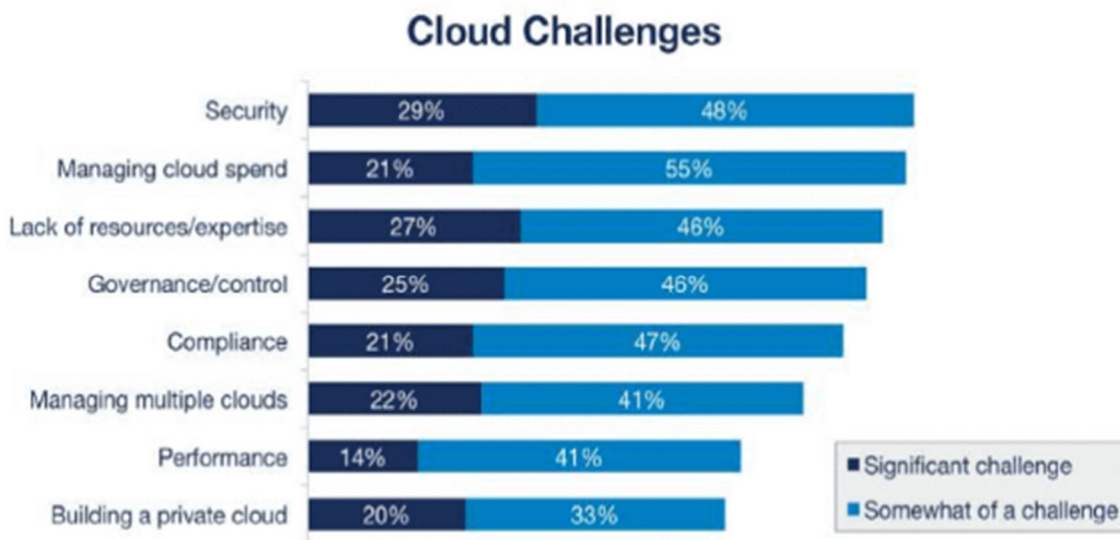
- 1) Where should I be, who is teaching me, where is that?
- 2) What do I need to hand in, when is that, what is that?
- 3) What did I get in this subject, how am I doing overall?
- 4) What books do I have out, when is that due back?

C. Challenges

As per the RightScale 2018 report[4] the top challenges in cloud computing are as follows:-

- 1) Security issues
- 2) Cost management and containment
- 3) Lack of resources/expertise
- 4) Governance/Control
- 5) Compliance
- 6) Managing multiple clouds
- 7) Performance
- 8) Building a private cloud

The pictorial representation of the above can be as follow



Source: RightScale 2018 report

D. Issues

The main issues for adoption of cloud computing so that state universities of Khordha District, Odisha can provide E-learning platform & E-library(Virtual library) facility on 24x7 basis are:-

- 1) Storing a huge amount of educational information securely.
- 2) To help their students as well faculty and other staffs to access these data anytime ,from anywhere in a secure manner on 24x7 basis.
- 3) Lack of sufficient IT support staffs to resolve any technical issue on an urgent basis.

E. Objectives of the Study

- 1) Benefit of adoption of cloud computing by all state universities of Khordha District, Odisha.
- 2) The challenges to be faced by all state universities of Khordha District, Odisha after adoption of cloud computing.
- 3) The main issues to be dealt with by the above universities due to the implementation of cloud computing.
- 4) Providing a solution through a study in this paper to the present which is future ready.

F. Hypothesis of study

- 1) Cloud computing will not increase the working efficiency of universities of Odisha.
- 2) Cloud computing is a secure technology.
- 3) Management and staffs of universities are not hesitant to adopt the cloud computing technology.
- 4) Cloud computing does not support green IT movement

G. The Literature Review

The literature review informed me regarding the basic concept of cloud computing, benefit of adoption of cloud computing by all state universities of Khordha District, Odisha, challenges involve in adoption of cloud computing and the security as well as other issues regarding adoption of cloud computing. The literature review has collected from different research articles, journals, different websites and blogs.

H. Quantitative Analysis

The quantitative analysis survey has done by sending questionnaire via survey monkey to total 70 members including faculty members, staffs, students of state universities of Khordha District, Odisha and IT specialists from in and out of the universities. I got reply from total 38 respondents. Then the received respondents' data was being compiled using Survey Monkey. The questionnaire is based on my objectives. It included questions of knowledge of cloud, security issues of cloud, benefits of adoption of cloud computing by universities, will the adoption of cloud computing is economical in long run for universities and is cloud computing an expensive technology.

I. Qualitative Analysis

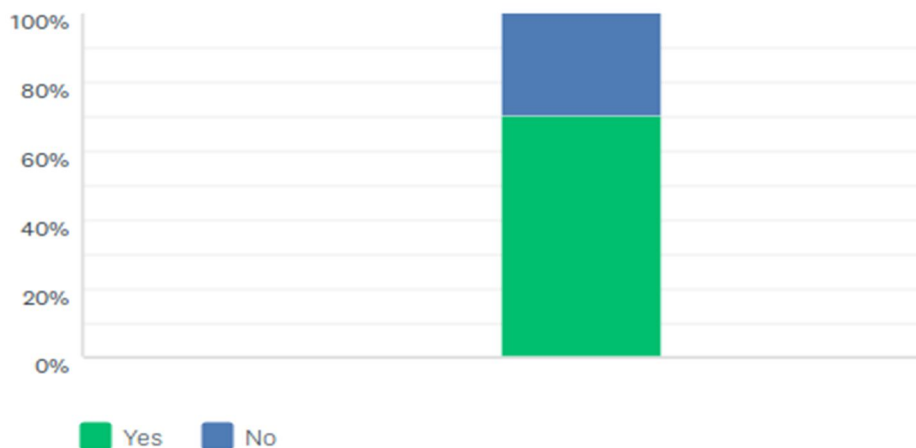
The interview has been taken from different IT specialists regarding cloud computing infrastructure, concepts, security issues and its benefit to universities from different aspects. From this interview what I found is that all the state universities of Khordha District, Odisha should adopt the cloud computing technology in academics as well as other activities to optimize their performance and to deliver a good online platform for their teacher as well as students a beautiful virtual environment to study and to teach.

III. ANALYSIS OF VARIABLE

Questionnaire on general knowledge and common perception regarding the adoption of cloud computing technology by all state universities of Khordha District, Odisha, India.

1) Q 1. Do you know about cloud computing

Chart 1:-Knowledge about cloud computing



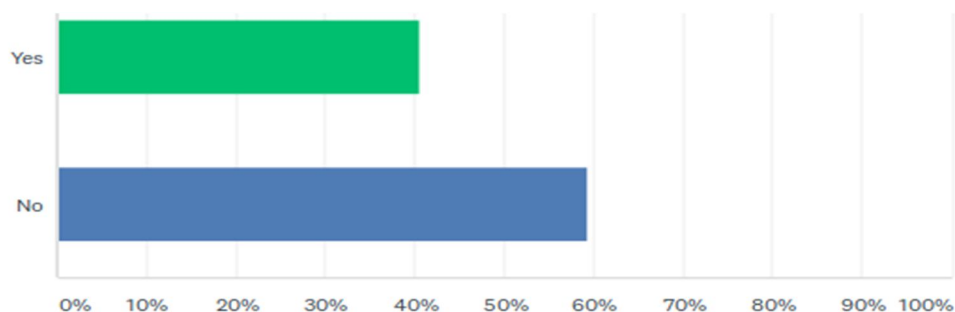
ANSWER CHOICES	RESPONSES
Yes	70.27%
No	29.73%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* It has founded from the survey that 70.27% have knowledge about cloud computing and only 29.73% do not have the knowledge about cloud computing

2) Q2.Do you think cloud computing is complex technology

Chart 2:-Peoples' perception regarding complexity of cloud computing



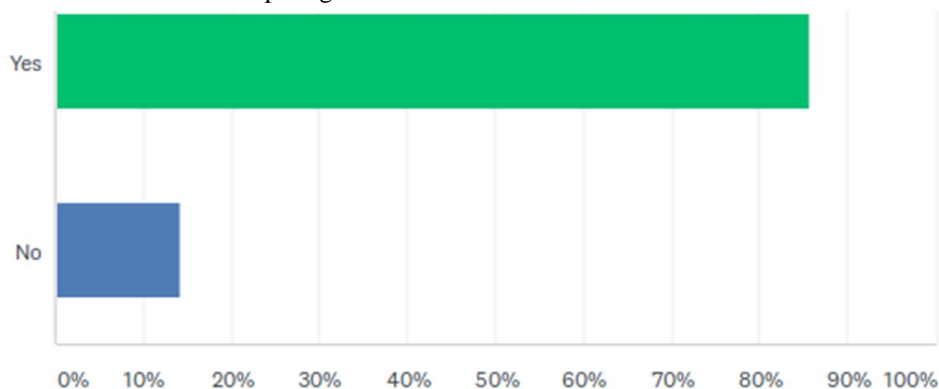
ANSWER CHOICES	RESPONSES
Yes	40.54%
No	59.46%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* It has founded from the survey that 59.46% think that cloud computing is not a complex technology whereas 40.54% think that loud computing is a complex technology .

3) Q3.Adoption of cloud computing by universities of Odisha is beneficial for smooth working of Universities.

Chart 3-: Cloud computing is beneficial for universities of Odisha



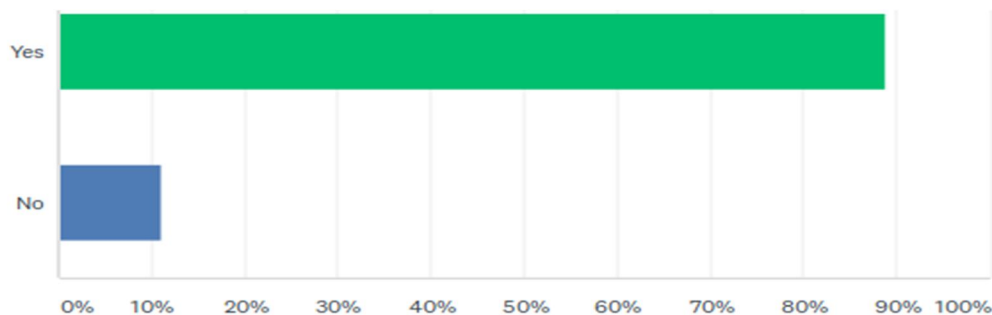
ANSWER CHOICES	RESPONSES
Yes	85.71%
No	14.29%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* After analysis of survey data I found that 85.71% think that adoption of cloud computing by universities of Odisha is beneficial for smooth working of Universities where as only 14.29% thinks that it is not beneficial for smooth working of Universities

4) Q4.Will it increase the working efficiency of universities of Odisha

Chart 4:-It will increase the working efficiency of universities of Odisha



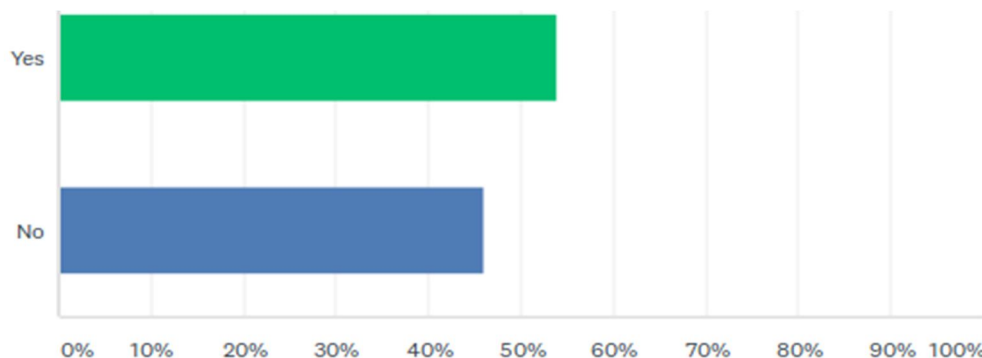
ANSWER CHOICES	RESPONSES
Yes	88.89%
No	11.11%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* What I found after analysis of survey data is that 88.89% think that it will increase the working efficiency of universities of Odisha and just 11.11% think that it will not increase the working efficiency of universities of Odisha .

5) Q5.Do you think cloud computing technology is expensive

Chart 5:-Peoples' perception regarding economical feasibility of cloud computing



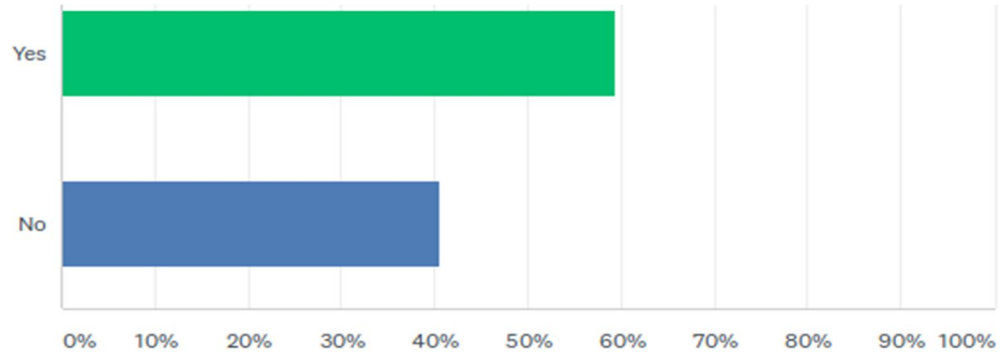
ANSWER CHOICES	RESPONSES
Yes	54.05%
No	45.95%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* I got a peculiar mixed response ,when I analyzed the survey data of this question.That is 54.05% of the respondent think that cloud computing is an expensive data where as 45.95% of the respondent think that it is not expensive.

6) Q6. Do you think security will be a major issue for adoption of cloud computing by universities of Odisha

Chart 6:- Concern regarding security of adoption of cloud computing



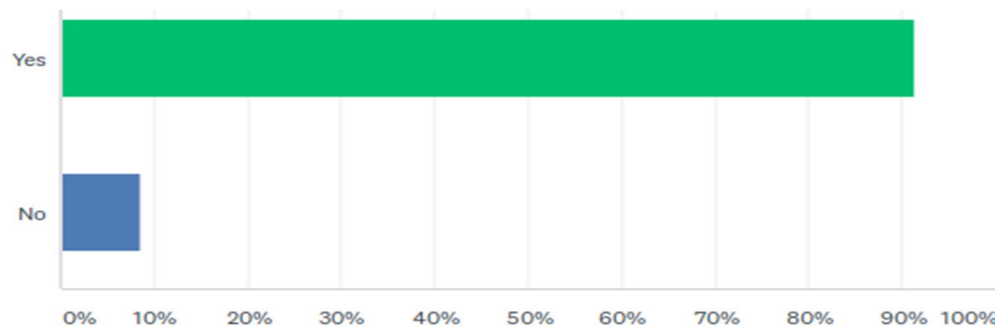
ANSWER CHOICES	RESPONSES
Yes	59.46%
No	40.54%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* From analysis of survey result, I found that 59.46% of the respondent think that security will be a major issue for adoption of cloud computing by state universities of Khordha District, Odisha and 40.54% of the respondent think that security will not be a major issue for adoption of cloud computing by state universities of Khordha District, Odisha.

7) Q7. In long run will it be economical for the universities of Odisha

Chart 7:- from future perspective will it be economical



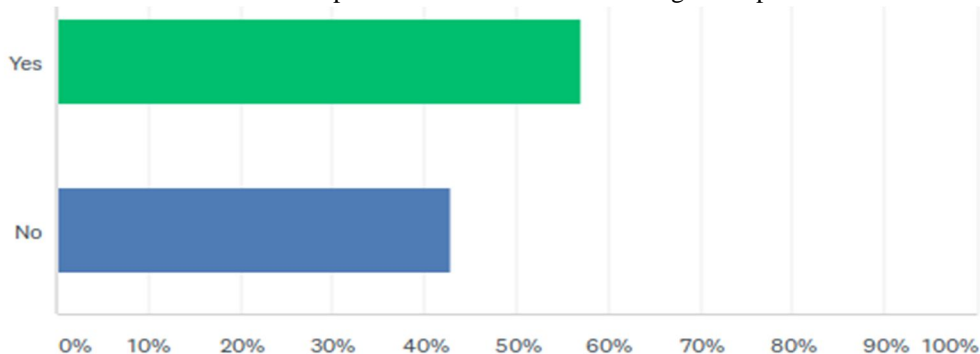
ANSWER CHOICES	RESPONSES
Yes	91.43%
No	8.57%

Sources compiled from by Survey Monkey from collected data

a) *Interpretation:* I am really felt happy when after analyzing the data of this survey question because major respondent 91.43% feel that In long run will it be economical for the universities of Odisha, only a minimal number of 8.57% think its reverse.

8) Q8.Are the management and staff of universities of Odisha hesitant to adopt cloud computing.

Chart:- Management and staffs of all the state public universities are not willing to adopt it.



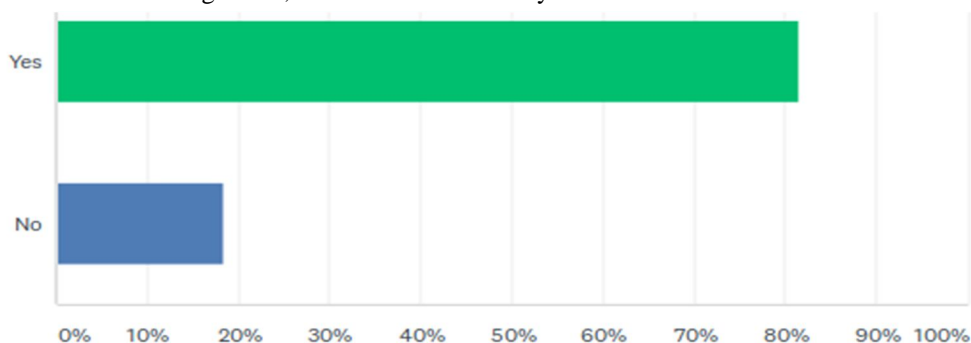
ANSWER CHOICES	RESPONSES
Yes	57.14%
No	42.86%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* What I found after analyzing this questions' data is that its a major issue to be dealt .Because 57.14% think that the management and staff of universities of Odisha hesitant to adopt cloud computing which is a big concern for all of us .On the other hand 42.86% think that it is not the case.

9) Q9.Should all the universities of odisha start an initiative to adopt cloud computing technology

Chart 9:- For the overall growth ,initiation should start by all the universities



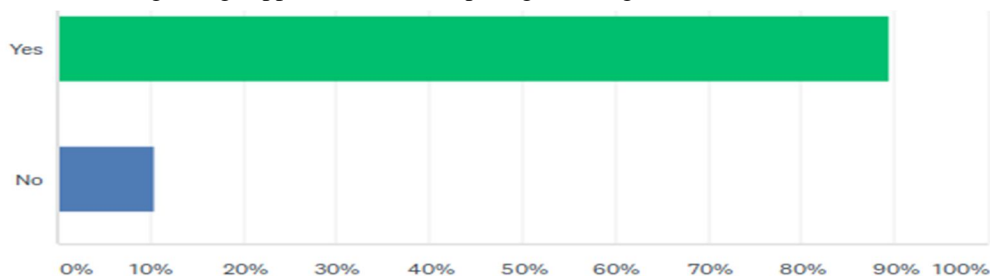
ANSWER CHOICES	RESPONSES
Yes	81.58%
No	18.42%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* For this question 81.58% of the respondent think that all the universities of odisha should start an initiative to adopt cloud computing technology on the vice-versa only 18.42% of the respondent think that it is not the case.

10) Q10. Do you think adoption of cloud computing support green IT movement.

Chart 10:-Peoples' concern regarding support of cloud computing toward green IT movement



ANSWER CHOICES	RESPONSES
Yes	89.47%
No	10.53%

Sources compiled by Survey Monkey from collected data

a) *Interpretation:* This is an eye opener question for all of us .Because we should support green IT movement to sustain our earth. What I found from the analysis of survey for this question is that 89.47% respondent think that adoption of cloud computing support green IT movement. Which is a really great outcome of my study.Only 10.53% respondent think against it.

IV. TESTING OF HYPOTHESIS

- 1) *Cloud Computing will not Increase the Working Efficiency of Universities of Odisha:* In view of hypothesis 1 :I found that from my survey cloud computing will increase the working efficiency of universities of Odisha Which has responded by 88.89% .Thus null hypothesis $[H_0]$ is rejected and alternate hypothesis $[H_1]$ is establishes that cloud computing will increase the working efficiency of universities of Odisha.
- 2) *Cloud Computing is a Secure Technology:* In view of hypothesis 2 :I found that from my survey that 59.46% think that security is a major issue for adoption of cloud computing by all state universites of khordha district ,Odisha,India. So null hypothesis $[H_0]$ is rejected and alternate hypothesis $[H_1]$ is establishes that security is a major issue for adoption of cloud computing by universities of Odisha.
- 3) *Management and Staffs of Universities are not Hesitant to adopt the Cloud Computing Technology:* In view of hypothesis 3: I found from my survey that 57.14% respondent think that management and staffs of universities are hesitant to adopt the cloud computing technology. Thus null hypothesis $[H_0]$ is rejected and alternate hypothesis $[H_1]$ is establishes that management and staffs of universities are hesitant to adopt the cloud computing technology
- 4) *Cloud Computing Does not Support Green IT Movement:* In view of hypothesis 4: I found from my survey that 89.47% respondent think that cloud computing support green IT movement which is remarkable .So null hypothesis $[H_0]$ is rejected and alternate hypothesis $[H_1]$ is establishes that cloud computing support green IT movement.

V. ISSUES FOR RISK MANAGEMENT

After analysis litreature review ,qualitative and qnanitative analysis I suggest to the management of all the state public universities of khordha district Odisha to resolve the issues of risk management for adoption of cloud computing are:-

A. As per Press release dated 26th March,2019,newsroom,Gartner inc.There are a variety of factors — global regulatory compliance, growing Internet of Things (IoT) landscape, expanding software as a service (SaaS)portfolio — that are starting to force higher education institutions to address security and risk matters with a multidimensional strategy. “Next-generation security must offer new approaches that support digital business and the institutions’ academic, research and business objectives,” said Ms. Morgan. “The average modern-day student expects seamless personalized experiences, so the typical security objectives of confidentiality, integrity and availability must expand to include privacy, safety and reliability as institutions become more digital”[13].

- B. Having complete compliance to copyright and IPR and privacy protection law.
- C. Regular monitoring costs of cloud services are important in a “pay-per-use” model as costs can quickly escalate with increase of use[9]
- D. Management of universities should ensure 24x7 availability of high speed internet service ,in absence of which the students,faculties or other job may hamper.

VI. FINDINGS AND SUGGESTION

This paper is an attempt to use cutting edge technology of cloud computing in academics by all the state public universities of khordha district Odisha,so that there overall IT efficiency will increase .Also it will be economical for them in long run .The challenges for adoption of cloud computing for all the state public universities of khordha district Odisha is still the security issue of the cloud computing. Because I found from the survey result that maximum respondent think security is a major issue for adoption of cloud computing.

I found its benefit for universities and can be used in teaching and learning process in following way:-

- A. It is reliable and economical in long run for the universities.
- B. Universities does not have to hire a cloud specialist ,because any person of the universities with basic knowledge can be trained by the cloud provider to handle Saas, Iaas or Paas from the university hand.
- C. The risk of database crashing will not be there ,because Universities data are stored on multiple database of cloud service provider. Cloud service provider’s database are much more secure.
- D. Even with a limited IT budget the universities has the luxury of using all the cloud services for academics starting from maintaining student database, e-learning, virtual library, online attendance monitoring system and maintaining staff and student bio metric system.

VII. FUTURE SCOPE FOR RESEARCH ON CLOUD COMPUTING

As I have seen benefits of adoption of cloud computing is manifold. Adoption of cloud computing by all the state universities of khordha district, Odisha can reduce the expenditure on IT budget to buy large amount of hardware, software and also in the IT maintenance point of view. Also as I found from my survey result that maximum respondent think cloud computing support green IT movement ,which is the emerging technology to support our environment from IT perspective. So more research can be carried out on relation of green IT with cloud computing or green cloud computing.

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