CHAPTER 4
STRATEGIC ANALYSIS FOR PROPOSED
E-LEARNING MODEL

In this chapter the researcher introduces analysis and the factors success of such initiatives taken to design an e-Learning model using cloud computing through literature review and data analysis of the accomplished case studies, success means here that objectives and outcomes or research should match. If objectives and outcomes differ, the initiative is not completely successful regarding the initial purpose.

Strategic analysis of pros and cons of using cloud technology to design e-Learning system is a main part of this chapter. The success and failure factors discussed further in this chapter.

Based on our literature review we can say now e-Learning systems usually require expensive software and hardware resources which many of the educational institutions cannot afford even though cloud computing can be the best solution for them. The peculiarities and a specific approach for cloud computing in e-Learning domain requires measures of the positive impact of using cloud computing architectures upon e-Learning solutions development. We design and used a set of cloud computing efficiency metrics for enhanced e-Learning implementation model. Also, overall efficiency of the use of cloud computing in e-Learning system is evaluated.

4.1 PROJECT MANAGEMENT MEASUREMENT OF CLOUD COMPUTING

There is likelihood that the future has a place with the Web 3.0 (moreover called the intelligent Web) [3]. This new condition supports the making of another time of employments that can continue running on a broad assortment of equipment gadgets, like mobile phones or PDAs, while securing their data inside the cloud. The prerequisite for preparing is growing persistently and the progression and the change of the e-learning courses of action is essential. Furthermore, the e-learning structures need to keep pace with the new development, so we can use the vitality of distributed computing.

The accompanying ranges focus on conveyed processing thoughts and the upsides of distributed computing for e-learning plans. Moreover, the impact on e-learning courses of action in light of
distributed computing venture administration is dissected. This is imperative for the advancement of e-learning arrangements in light of distributed computing and to discover achievement and disappointment elements.

4.1.1 Project management for cloud computing e-Learning system

Our Proposed distributed computing based e-Learning model takes after a same life cycle as whatever other programming improvement project. To be specific, distributed computing improvement administration includes the accompanying procedure gatherings:

- Project start
- Project arranging
- Project execution
- Project observing and controlling
- Project shutting

Project start

The venture sanction and the advancement of the preliminary project scope articulation are worked upon in this. Sanction formally approves the improvement extend and supplies project manager with the expert to utilize hierarchical assets to extend exercises.

The Project scope the focused on achievement, i.e. the useful particulars without bounds e-learning framework and the venture targets that must be met. The proficiency which is quantitatively measured has an essential effect upon the productivity without bounds distributed computing based e-learning.

Project arranging

To the service providers, lease will be paid in light of the utilization of distributed computing framework, so the venture chief's concentration moves from picking the correct innovation to picking the correct merchant. More concentrate is on the processing energy of the architecture. The expenses of scaling up the e-learning framework in view of the parameters, for example, reinforcement and alternate courses of action, benefit accessibility, information security and the distributed computing merchant offers, and so on is observed. The calculation of the availability of the cloud computing based e-learning system is:
Availability = (UpTime/365*24*60*60) * 100 %

Where:

Availability – the accessibility of the framework amid a year. A is measured in percent.

UpTime – the total time for which e-learning system is up and running, measured in seconds.

365*24*60*60 – number of seconds in a year.

Service accessibility of A of over 99% is viewed as a profoundly accessible e-learning framework.

Because of business oriented nature, cloud computing based project activities, the service provider after taking initial burden offers on-demand virtualized processing power to customers.

The service supplier by absorbing the in advance costs, spreads the expenses over a more extended period and disperses it to more than a few distributed computing clients. Along these lines, change of the underlying capital is used to the progressing operational use for the e-learning framework support.

Metering of standardized resources usage based on actual consumption takes place in cloud model of software as services. Utility computing and pay-as-you-go models for hardware usage are introduced to charge the customer, be it server- RAM-hours, CPU-hours, gigabyte-storage-hours, etc. For renting a dedicated server from a datacenter we use currently spread standardized-server-configuration-hours and GB of data transferred for network bandwidth usage, as and when the resources are no longer in use they are relinquished. Both inborn framework components and execution testing on the distributed computing engineering ought to be tried and thought about.

**Project execution**

Coordinating and dealing with the venture advancement and performing continuous quality assurance form the piece of Project Execution. For a fruitful distributed computing based e-learning framework to be produced, inheritance programming advancement strategies can be effectively utilized i.e. source control programming, assemble scripts for building the sending bundle and computerized tests for regression testing.
Venture criticality examination techniques [37] can be effectively utilized with a specific end goal to improve the venture advancement quality.

An important instrument for observing undertaking progress and envisioning any issues the venture is performed by Earned esteem administration technique.

**Project observing, controlling and shutting**

Concluding all venture exercises and playing out the acknowledgment and conveyance of the last e-learning framework is performed in Project Closing. In this against the underlying targets, extend degree is checked, the documentation of e-learning framework establishment and upkeep, the last item acknowledgment testing is performed and after that the execution of the formal shutting of the venture.

The advancement of e-learning arrangement runs in a state of harmony with the distributed computing patterns. Drawbacks incorporate the impact it makes in transit the e-learning programming ventures are overseen. For discovering suppliers for distributed computing different prerequisites are checked like foundation, stage or administrations, cost and hazard administration additionally impact the way the e-learning arrangements in light of distributed computing are overseen.

**4.2 ANALYSIS OF CLOUD COMPUTING CONCERNS**

Cloud computing has grown from being a promising business concept to the fastest growing segments of the education and ICT industry. Companies are increasingly realizing the cost cutting by tapping into the cloud. They can gain fast access to solution for software applications and drastically boost their infrastructure resources, all at negligible cost. The major concern was “how safe an environment it is” [62].

**a) Security**

Many argued about the customer data security which as per them is more secure when internally managed, while others argued that to maintain trust and employ a higher level of security, cloud providers will have a strong incentive. In the cloud, the data is distributed over individual computers regardless of location of base repository of data. Though Industrious hackers can virtually invade any server, there are the statistics to show that breaches result from stolen or lost
laptops, also accidentally from other devices and by exposing data on the Internet and nearly 16 percent due to insider theft [62].

b) Privacy

In the virtual computing technology, users’ personal data may be scattered in various virtual data center. The systems may not be in the same physical location or within the national borders, so data privacy protection will face the controversy of different legal systems. Sometimes while accessing cloud computing services, users may leak hidden information. Attackers analyzing the critical task too can attack the users [62].

c) Reliability

Servers in the cloud too experience downtimes and slowdowns. The difference is that users have a higher dependency on cloud service provider (CSP) in the model of cloud computing. In the CSP’s service model, once you select a particular CSP, you are locked-in and it brings a potential business security risk.

d) Legal Issues

Efforts have been made to line the lawful situation still worries stick with safety measures and confidentiality from individual all the way through legislative levels.

e) Open Standard

Open standards help most cloud providers to expose well documented APIs which are also unique to their implementation. Some vendors have adopted others' APIs and open standards including the OGF's Open Cloud Computing Interface.

Cloud computing standards and practices are being developed by the Open Cloud Consortium (OCC).

f) Compliance

The storage and use of data require regular reporting and audit trails. Customers must comply appropriately with these regulations. A stronger management and enforcement of compliance policies can be achieved well by managing compliance and security for Cloud Computing. Subject to compliance requirements by Data centers should also be maintained.
g) **Freedom of choosing the best**

Users are not allowed to physically possess the storage of the data. Cloud providers have the data storage and control in their hands. Customers can retain their own copies of data.

h) **Long-term Viability**

The data put into the cloud will never become invalid even when cloud computing provider either breaks down or is swallowed by a larger company.

i) **Solution**

Encrypt the data with your own keys before storing it at virtual location. A vendor has to be ready with security certifications and external audits. Before selecting a CSP, identity management, reporting of security incidents, access control, personnel and physical layer management should be evaluated. Minimized personal information should be stored in the cloud. CSP should maximize the user control and provide feedback. Organizations need to run applications and data transfer in their own private cloud and then transmute it into public cloud. While there are many legal issues exist in the cloud computing, Cloud Security Alliance should design relevant standards as quickly as possible.

### 4.3 DEVELOPING CLOUD COMPUTING STRATEGIES FOR E-LEARNING

It is impossible that cloud computing can address the majority of the IT issues, however it could be the response to some certain ones[13]. Each separate learning unit should utilize its own due tirelessness to decide if the advantages of distributed computing exceed the dangers, in light of its unique environment and institutional conditions. Analysts at Infosys Corporation propose that progressive steps are required for cloud selection. Among these are evaluation, approval, readiness, and execution [7].

### 4.3.1 Hardware Cost estimation

Cloud computing model needs large scale datacenters. “A large datacenter (50,000 servers) vs. a medium one (1,000 servers) vs. has an average factor of 3 to 7 times less costs to be able to buy
server hardware, provide a monthly storage in terabytes, and a network bandwidth in Mega Bytes and ultimately also have lower labor costs for the administration of a single server (1,000 servers per administrator vs. 140 in a medium datacenter). Amazon's announcement of capacity reservations/pre-paid instances is likely to be followed by other cloud providers, as this enables them to make better planning of their own resources, save costs and be able to offer longer-term commitments at lower prices”[61].

4.3.2 Server Virtualization

Virtualization is a layered approach to manage huge data volumes from disparate sources (databases, systems and storage), through a single virtual view from within a front-end system, such as applications, or dashboards. Improved profitability and reduced risk for new business developments make Data center solutions accelerate service delivery, by detaching workloads and data. To be more specific, the benefits can be identified from all three forms of virtualization: server virtualization, desktop virtualization and virtualized appliances.

The main advantages that businesses benefit from are:

- Easy access to data.
- Share applications instances between multiple organizations.
- Reduced costs.
- Operational system efficiency and simplified management due to better use of infrastructure.

With a specific end goal to assess the monetary feasibility of moving to the cloud, the Total Cost of Ownership of the advantages included should be considered.

Virtualization allows you to do more with your existing resources by decoupling software (like servers) from their underlying hardware. With Virtualization, your server has a smaller footprint which is a cost saving and it’s poised to move quickly when hardware or security failures occur.

“A Cloud network has similar advantages but takes virtualization a step further.” The scalability allows you to pay for only what you use and, if your demands change the new needs are instantly met. On a cloud platform, multiple hardware devices and load balancing monitors are active which translates to improved reliability and performance of your services. Improved reliability is
achieved by removing the single point of failure. Also reduce energy wasted running under-utilized computing equipment is achieved.

“Initially used just for cost reduction, server Virtualization is now also being used to speed up operational processes and server deployment, create disaster recovery solutions where they didn’t exist before, and improve server availability. X86 architecture server Virtualization is now considered a mainstream trend (roughly 25% of the market penetrated), and the strategic path from server Virtualization to cloud computing is becoming more apparent to enterprises.”

**Determining the cost of the cloud**

Both capital and operational expenditures are taken into account to calculate the monthly costs for a cloud computing deployment.

For capital expense cost items, the cost of each item needs to be amortized over the life of the item. Typically servers have a lifespan of 3 to 5 years, while datacenter facilities have a life of 10 to 15 years.

By combining the monthly costs for the operational expense items with the calculated monthly costs for the capital expense items, the total monthly costs of the cloud deployment can be determined.

**4.4 PRIVACY AND SECURITY ISSUES**

The Cloud is a large scale complex for data storage and processing which delivers software as an online service and connection of wireless devices to services and applications. Cloud computing minimizes capital expenditure and lowers barriers to entry for users.

It enables users to access data and systems regardless of geography or available media. According to a study by the Pew Internet & American Life Project, “66 percent of Americans connected to the Web use some kind of cloud service, including storage of computer files and personal photos, online hard drive back up, and Web based e-mail. Blogs, wikis and social networks—all popular consumer-facing services that enable better collaboration—are cloud based.”

Cloud computing empowers companies to redirect resources toward core functions and competencies and the ability to expand and enhance services.
4.5 THE TRADITIONAL IT BASED AND CLOUD BASED E-LEARNING

Large investments in IT infrastructure may be required in deploying e-Learning systems and solutions, using the traditional model but still the optimal utilization of resources may not be achieved. Further to expand businesses only setup an in-house (On-Premise / Hosted) computing environment may not be sufficient so they have to build IT teams to manage the bigger structure thereby adding on to costs.

4.6 STUDY OF CLOUD CAMPUS

Cloud campus is a phenomenon of the 21st century, which takes you beyond the traditional classroom based education system allowing you to learn on the move. It can be used to simplify the provision of various educational resources to teachers and students. Cloud campus is a term derived from cloud computing where you can store your data on cloud and retrieve it from any device connected to that cloud. Cloud allows you to share any files such as education books, software etc with anyone connected to that cloud.

NIIT Limited, leading Global Talent Development Corporation and Asia’s largest IT trainer, announced the launch of new-age GNIIT programme that can be pursued anywhere anytime, by leveraging the unique cloud learning methodology.

The pioneering NIIT Cloud Campus empowers the student to learn on his own terms, at his own pace, wherever and whenever he wants it. Students enjoy higher mobility as they can easily access educational services using a Netbook or a Mobile device that connects them to NIIT’s Cloud Campus™ network. These services will be managed by NIIT centrally using the power of Cloud Computing.

An initiative of NIIT i.e. the new GNIIT syllabus is based on a revolutionary educational paradigm called collaborative learning. Collaborative learning takes students beyond the traditional classroom based student-teacher relationship. Students enrolling in GNIIT will be provided with netbook which is technically robust, well-designed digital courseware and a data card which is fully paid. NIIT’s Cloud Learning Methodology offers features like 24x7 lab, interaction with faculty and peers, access to video streams online and e-library access. As an icing on the cake they also provide instant tech updates. Thus the learning process is enhanced through group learning.
4.7 COMPREHENSIVE ANALYSIS AND SURVEY

The information in this section is based on the results of surveying almost 1250 different participants that includes IT-architects, business development manager, executive consultant, chief technical officer, programmers, business consultant, CEO and end users who are actual stakeholder of proposed e-Learning model, either linked or aware with cloud computing or e-Governance. Both the surveys were done in the period between May 2014 to Jun 2014 & October 2015 to December 2015.

4.7.1 Research Questionnaire on E-Learning with cloud

(Data collected from May, 2014 to June, 2014)

4.7.1.1 Respondents break-down as follows:

• Age group of respondent: 70% of respondent are of age 18-30 Years. 28% are of 31-45 years and rest 2% belongs to 46-60 years age group.
• **Gender ratio:** 72% male respondents register their responses in comparison to 28% female respondent.

![Gender Ratio Chart]

• **Living habitat:** 59% of respondent are from urban area, 11% are from rural, whereas 31% are from semi-urban area, which shows that the data is collected from all habitat.

![Living Habitat Chart]

• **Working Ability:** The survey has been given to almost all the sectors of economy. 55% private sector respondent records their responses in comparison to 6% government sector. Student shows high interest and 26% responded to the survey. Business Owner, Housewife, Unemployed, Retired and others shares 2%, 5% & 6% responses.

![Working Ability Chart]
• **Thinking level of Respondents:** Thinking level of any person can be decided with its education. Maximum of our respondent (54%) are post-graduate and above & 4% are doctorate which means that we have an assurance of correctness of data. 22% have passed Professional education and 19% are Graduate. Only 1% of our respondents are of higher secondary.

![Pie chart showing education level distribution]

4.7.1.2 Internet Access

Internet is the basic need for any E-Learning service. As we all know, the number of Internet users in India has reached 205 million in October 2013, registering a year on year growth of 40% over last year. By December 2013, it is expected to reach 213 million [I-Cube 2013 report, released by the Internet and Mobile Association of India (IAMAI) and IMRB International] [1]. And also, India is now world’s third largest Internet user after U.S. & China [2].

So first of all it is benefited to see that through which device user generally access internet, so that E-Learning services can be given a better framework.

**Q1. You access Internet through**

![Bar chart showing Internet access device]

- Mobile: 35%
- Laptop: 40%
- Personal Computer: 20%
- Tablet: 5%
60% pupils uses internet on either laptop (40%) or PC (20%). 35% of the respondents uses their mobile while accessing internet and 5% uses tablet.

**Q2. How frequently you access Internet?**

- Daily 90%
- Twice in Week 6%
- Fortnightly 1%
- Monthly 3%

A very important fact comes through this question that almost all (90%) pupils use internet daily. 6% uses twice in a week, 3% monthly and 1% fortnightly, these are the persons like housewife/unemployed.

**4.7.1.3 E-Learning Awareness and Adoption**

According to WEF Global Information Technology Report [3], India ranks 24th out of 134 countries with 5.38 score in accessing and overall priority of ICT. Therefore e- Governance has the potential to provide exponential benefits to the citizens and maximize return on government investment which represents the growth of E-Learning in India is quite encouraging.

31 mission mode projects (MMPs) are classified as state, central or integrated projects.

**Q3. E-Learning means online learning, Are you aware that Indian Government is also offering many E-Learning project?**

- Yes 71%
- No 29%

Almost 71% of the candidates are aware of the E-Learning projects, & 29% are unaware.
Q4. Are you aware about National E-Learning Plan?

53% of the total respondents are aware of the NeGP (National E-Learning Plan), while 47% are unaware.

Q5. Do you trust online services?

85% pupils trust online services and 15% says they do not trust.

Q6. Do you believe that old government processes should be re-designed as there are some problems?
89% respondent agrees that old government process should be re-designed because of various problems. 11% do not think like that.

**Q7. Before obtaining any government services do you check website of concern department?**

71% checks the website of concern department before using any government service and 29% do not.

**Q8. E-Learning has reduced time and cost.**

This is the main reason why people want to use e-Learning. 73% respondents think that E-Learning has reduced time and cost while 27% were against.

**Q9. E-Learning offers Error free and easy learning.**
57% pupils support that E-Learning offers easy learning. 43% thinks there are errors in the E-Learning model.

**Q10. E-Learning reduces visits in schools and colleges.**

E-Learning services provide door-step facility to its citizens. 86% of our respondents agree that E-Learning reduces visits in school or college. 14% denies the fact.

### 4.8.1.4 E-Learning Factors

Various factors important for any government services are Trustworthy, Transparent, Timely service delivery, speed of service delivery, 24x7 availability. Below responses shows how citizens thinks about the importance of various factors.

**Q11. What is the most important factor according to you when you think of any government services?**

Trustworthy, Transparent, Timely service delivery, Speed of service delivery, 24*7 availability of service
If above responses are summarized we found that 42% of pupils give rank 1 to trustworthy, 33% gives rank 1 to Timely service delivery, 31% gives rank 1 to transparency. 29% Respondent thinks that Speed of service delivery should be first factor before thinking of any government service, whereas 28% gives their first choice to 24*7 availability of service.

From this summary we find that all the above factors are almost comparative to each other.

4.7.1.5 Expectations of Citizens from Government Service.

There is an overwhelming perception among the public that public services need to improve. This research review shows citizen satisfaction is a powerful driver of change.

Q12 A) Please select appropriate for measuring effectiveness of any government services

Citizen Expectations for Government services

1. Quality of Service is required

Quality of services is the overall performance of the service, particularly the performance seen at user level. It is also a comparison of expectation with performance [5].
58% strongly agree and 29% agree that quality of service is required in a government service.

2. **Transparency in Operations are necessary**

![Graph showing the distribution of responses to the transparency in operations question.]

Transparency, however, may be defined as not only the disclosure of government information, but the access, comprehension, and use of it by the public [6].

89% of total responses either strongly agree (55%) or agree (34%) that there must be transparency in operation of any government service.

3. **Government services should be trustworthy if it is online service**

![Graph showing the distribution of responses to the trustworthiness in online services question.]

Trustworthiness is “the perception of confidence in the electronic marketer’s reliability and integrity” [7]. Lack of trust prevents users for adopting E-Learning services.

84% of citizens either strongly agrees (58%) or agree (26%) with this factor, whereas 14% neither agree nor disagree (neutral).

4. **Speed of delivery of service is important**
Speed of delivery is also one of the main criterions in judging quality of service. 92% of respondent strongly agree (59%) or agree (33%) with this factor.

5. **All services form one person / table is more convenient**

Under the one person/table paradigm, all of a customer's service can be completed in a single window. One-stop customers do not have to hunt around, call back, or repeatedly explain their situation. One-stop customer service is convenient, accessible, and personalized.

71% of our respondents agree (31%) or strongly agree (40%) with this factor of government service. 20% becomes neutral and rest (7%) disagree with this factor.

6. **Service should be easily accessible**
The objective of this factor is to provide an easy-to-reach and access of government services and information by citizens. The goal is that information resources are widely accessible to the general public so that they promote innovation and research activities, the development of digital products, services and markets, the efficiency, impact and transparency of public administration and citizens’ participation in decision-making [8].

95% of respondent agree (35%) or strongly agree (60%) to this factor. This shows that all citizens think that government services should be easily accessible.

7. **E-Learning project reduces cost of obtaining service**

The involvement of technologies like virtualization, consolidation and cloud computing and adoption of free and open source software in designing & deploying E-Learning will lead towards reduction in total cost associated with both hardware as well as software. Therefore it reduces the financial burden abide by the state and central governments [9].

78% pupils strongly agree [40%] or agree [38%] with this factor. 13% of respondent neither agree nor disagree with this factor.

8. **E-Learning Improves quality of education services**
E-Learning acts a strategic tool for transforming Governance and improving the quality of services provided by the government to its people. Information technology has been found to be very useful in reinvigorating the government administrative systems by enhancing their capacity and efficiency [10].

81% support (strongly agrees (39%) & agree (42%)) that E-Learning improves quality of services whereas, 12 % becomes neutral at this factor. 7% respondents disagree with this factor.

9. Government should conduct awareness programs for various E-Learning services offered

Apart from building capabilities within the government, there is need for generating widespread awareness among the public at large. The success of E-Learning lies in increasing the number of electronic interactions between citizens and the government and not merely in building the infrastructure of E-Learning[11].

88% respondents agree (32%) and strongly agree (56%) that government should conduct awareness programs for E-Learning services. 7% neither agree nor disagree with this factor.

10. It is good to have 24*7 service availability online
24/7 service is a service that is available regardless of time or day. E-Learning services should be available 24/7 so that it helps citizens to regulate their relations with government in a faster, more reliable manner and without wasting time.

89% pupils strongly agree (63%) and agree (26%) about 24*7 availability of E-Learning services. 6% respondents becomes neutral about this factor, whereas 5% disagree.

4.7.1.6 Effectiveness of Government Services

11.  B) Please select appropriate for measuring effectiveness of any government services

Infrastructure Related

1.  Government staff have enough knowledge about software of service

48% of respondents agrees / strongly agrees that government staff have enough knowledge about software. 34% totally disagrees about the above criteria. 17% neither agree nor disagree.

2.  Government websites are working properly and updated timely
About 44% of total respondents agree (22%) / strongly agree (22%). 41% totally disagrees that Government websites are working properly and updated timely. 15% of respondent becomes neutral in this question.

3. **Computers are working well in government offices**

About 35% of total respondents agree (16%) / strongly agree (19%). 33% totally disagrees that computers are working well in government offices. 32% of respondent becomes neutral in this question.

4. **Government offices are now better in terms of IT hardware n software**
About 58% of total respondents agree (42%) / strongly agree (16%). 28% totally disagrees that Government offices are now better in terms of IT hardware n software. 13% of respondent becomes neutral in this question.

12. C) Please select appropriate for measuring effectiveness of any government services Government and E-Governance

1. **E-Learning Projects ensures security of transaction**

   ![Bar chart]

   At the transaction stage, the public would be able to carry out (financial) transactions with the government. This would require higher levels of processing capability, as well as payment gateways and security implementation [12].

   81% pupils agree (50%)/ strongly agree (31%) that E-Learning Projects ensures security of transaction. 14% neither agree nor disagree with this factor.

2. **E-Learning Increases citizen empowerment**
Empowerment will be understood as participation in those decision making processes that impacts the social, political and economic conditions of society.

84% respondents strongly agree (29%) / agree (55%) that E-Learning increases citizen empowerment. 9% becomes neutral and 7% disagree.

3. **E-Learning increases efficiency in government services**

The government has undertaken several e-Learning initiatives to provide convenient and transparent services to citizens and to promote greater efficiency within the government department [13].

85% citizens accepts (Strongly agree (30%) & agree (55%)) that E-Learning increases efficiency in government services, whereas, 8% neither agree nor disagree and 7% totally disagree.

4. **E-Learning project reduces cost of delivering service**
One of the main benefits of E-Learning is that it reduces cost of delivering service, almost 83% agrees (50%) / strongly agrees (33%) at this factor. 12% neither agree nor disagree while 4% disagree with this factor.

5. **E-Learning involves huge cost**

44% agrees with this factor whereas 28% disagree that E-Learning involves huge cost. 26% respondents neither agree nor disagree.

6. **PPP (Public Private Partnership) is preferable for E-Learning**
Public-Private Partnerships (PPP’s) are contracts between a private sector entity and a government body that call for the private partner to deliver a desired service and assume the associated risks [14].

69% strongly agrees (26%) / agrees (43%) that PPP is preferable for e-Governance. Whereas 26% becomes neutral at this factor and 5% disagree at this.

7. **E-Learning Reduces administrative burdens**

Administrative simplification broadly refers to reviewing and simplifying unnecessary paperwork and formalities that governments impose on citizens [15].

77% of total respondent simply agrees (51%) / strongly agrees (26%), & 14% neither agree nor disagree, whereas, 8% of respondents disagree / strongly disagree with this criteria.

8. **E-Learning projects increases revenue of government**
The broader objective of E-Learning projects is to enhance the base of citizens who pay taxes, by simplifying procedures and improving the accessibility of collection centers, so that the revenues collected can be utilized for better maintenance of civic amenities and for developmental activities [16].

71% strongly agrees / agrees that E-Learning projects increases revenue of government, 21% neither agree nor disagree, & 6% disagree with the criteria.

9. **E-Learning has helped to improve the image of government**

Digital government has attracted attention as one way of improving citizen interactions with government and a possible remedy to the dilemma that citizen apathy and distrust pose for democracy [17].

35% strongly agree / 39% agree with this criterion, 17% becomes neutral and 10% totally disagree that E-Learning has helped to improve the image of the government.

**4.7.1.7 Who will be benefited of Government Services?**

12. D) Please select appropriate for measuring effectiveness of any government services E-Learning advantageous to whom

1. E-Learning services put the poor at disadvantage
49% people agree (32%) / strongly agree (17%) with this factor, 31% neither agree nor disagree & 20% of respondent did not thinks that E-Learning services put the poor at disadvantage.

2. E-Learning services benefit only the rich and influential

Only 26% agrees and 13% respondents strongly agree that E-Learning services benefit only the rich and influential, whereas, 43% disagree about this factor. 19% neither agree nor disagree.

3. E-Learning services benefit only the urban people

Only 27% agrees and 17% respondents strongly agree that E-Learning services benefit only the urban people, whereas, 39% disagree about this factor. 17% neither agree nor disagree.
4. Rural citizens benefit greatly from E-Learning services

35% agrees and 14% respondents strongly agree that E-Learning services benefit only the rural people greatly, whereas, 25% disagree about this factor. 26% neither agree nor disagree.

![Bar Chart](chart1.png)

4.7.2 Research Questionnaire on Cloud Computing
(Data collected from October, 2015 to December, 2015)

4.8.2.1 Respondents break-down as follows:

- **Age group of respondent**: 73% of respondent are of age 18-30 Years. 27% are of 31-45 years.

![Pie Chart](chart2.png)

• **Gender ratio**: 68% male respondents register their responses in comparison to 32% female respondent.

![Pie Chart](chart3.png)
• **Living habitat:** 61% of respondents are from urban areas, 14% are from rural areas, whereas 25% are from semi-urban areas, which shows that the data is collected from all habitats.

![Pie chart showing habitat distribution](image)

• **Working Ability:** The survey has been given to almost all the sectors of the economy. 70% of private sector respondents recorded their responses in comparison to 8% of the government sector. 9% of students responded to the survey. Business Owners, Housewives, Unemployed, Retired, and others share 8%, 1%, and 4% of responses.

![Pie chart showing sector distribution](image)

• **Thinking level of Respondents:** Thinking level of any person can be decided by their education. The majority of our respondents (57%) are post-graduate and above, and 4% are doctorates. This means we have an assurance of the correctness of the data. 21% have professional education, and 19% are graduates. Only 1% of our respondents are of higher secondary level.

![Pie chart showing education distribution](image)

4.7.2.2 Internet Access / Computer facility
Internet connection is must to access the cloud which means “if we want to look at a specific document we have housed in the cloud, we must first establish an internet connection either through a wireless or wired internet or a mobile broadband connection”.

1. **Is your Organization offers Computer facility**

   ![Pie Chart]
   
   Yes 97%
   No 3%

   97% of pupils say that organization offers computer facility, this is the basic feature needed for cloud computing.

2. **Is your Organization offers Internet facility**

   ![Pie Chart]
   
   Yes 98%
   No 2%

   98% of pupils say that their organization offers Internet facility. This gives a clear picture that nearly all the organization has the infrastructure ready for adopting cloud computing.

### 4.7.2.3 Adoption of Cloud in Organizations

3. **Does your organization use cloud computing?**
42% of respondents agrees that their organization use cloud computing. Whereas 58% says that their organizations does not use cloud computing.

4. Are you planning to use cloud computing support in your organization?

58% respondents are planning to use cloud computing support in their organization, and, 42% says no to this question.

5. What kind of cloud environment does the organization use/intend to use?
When respondents were asked that what type of cloud environment they are using or intend to use, 29% says they are using private cloud, 13% are using hybrid cloud, 8% are using public cloud, and 3% are using community cloud. Whereas, 39% don’t know about the type of cloud they are using, and 8% have no plans to adopt cloud.

4.7.2.4 Factors affecting Cloud/adoption of Cloud in School or college

6. Rate the following factors in driving your organization’s adoption of a cloud environment?

1. Flexibility

Cloud computing allows user to be more flexible. One can access files using web-enabled devices such as Smart phone, laptops and notebooks [18].

89% of respondents agree that flexibility is an important (52%) / extremely important (37%) factor. 8% says this factor is neither important nor unimportant, whereas, 3% says it as unimportant.

2. Scalability

Cloud computing allows business to easily upscale or downscale their IT requirements as and when required [18].
88% of respondents agree that scalability is an important (55%) / extremely important (33%) factor. 9% says this factor is neither important nor unimportant, whereas, 3% says it as unimportant.

3. **Simplicity**

Cloud promises simplicity for the end user as well as for the developer, by providing easy development environment, and interface.

80% of pupils agree that simplicity is an important (50%) / extremely important (30%) factor for adoption of cloud computing. 16% says this factor is neither important nor unimportant, whereas, 4% says it as unimportant.

4. **Security**
For cloud computing security is the foremost concern. Security and privacy involving storing and securing data, and monitoring the use of the cloud by the service providers is one of the main concerns. The security mechanisms between organization and the cloud need to be robust [19].

91% of pupils agree that security is an important (17%) / extremely important (74%) factor for adoption of cloud computing. 7% says this factor is neither important nor unimportant, whereas, 3% says it as unimportant.

5. **Advanced Technology**

88% of respondents agree that advanced technology is an important (51%) / extremely important (37%) factor for adoption of cloud computing. 8% says this factor is neither important nor unimportant, whereas, 4% says it as unimportant.

6. **According to the European Health Organization (EHO) “Data should not leave the original country of collection at any time, is it the main cause to restrict to put data in the Cloud?”**
53% thinks accepts the above quote of EHO, whereas, 47% not support this saying.

7. Which deployment method of cloud computing do you prefer to adopt to store your office records and data in to cloud?

42% of respondents have preferred private deployment method for cloud computing. 21% preferred hybrid computing, 8% prefer public cloud and 5% preferred community cloud. 24% respondents don’t know about the deployment method used.

4.7.2.5 Top challenges/concern of cloud computing faced by any organization

1. Rate the top challenges or concerns your organization faces in adopting a cloud environment? Is it Security, Regulatory compliance or IT governance?
61% of respondents think that security is the top-most challenges faced by organization in adoption of cloud environment. 42% agrees IT Governance & 31% thinks Regulatory Compliance is the top-most challenge.

2. Prioritize among the following benefits in adopting cloud computing in e-Learning?

**Cost savings, Security, Location independence, Reliability, Scalability, Fast services, sharing of information and data between different government offices**

Cloud offers above benefits, here we see that how user sees the benefit according to e-Governance.

40% and above respondents give highest rank to cost saving, security, location independence, fast services, sharing of information and data. Above 30% give their opinion to scalability and around 28% give rank 1 to reliability.

3. Prioritize among the following concerns while adopting cloud computing in E-Learning

**Security of the data, Scalability, Legal issues, Privacy concerns, Integration issues, Cost savings, Vendor lock-in, Data center location, SLA (Service Level Agreement), Trust of citizens**

55% of pupils think security of data as number one concern to adopt cloud computing in e-Learning. 38% respondents give rank one to privacy concern. 42% give their views for cost saving. Trust of citizen is also a main concern, 30% of respondents give rank one to trust. Scalability, data center location, legal issues, SLA is also some major concern.

4. Is it safe to store Government’s/Companies records/data into cloud?

![Pie chart showing responses to the question](chart.png)

40% of respondents thinks that it is safe to store Government’s/Companies records/data into cloud. 29% says No to their responses, whereas, 31% doesn’t know about this factor.
5. How important are the following factors in driving your organization’s adoption of a cloud environment?

- **Cost savings**

  [Bar chart showing percentages]

  91% pupils agrees that cost saving is extremely important / important factor in adoption of a cloud environment. 6% says it neither important nor unimportant, and 4% says it unimportant.

- **Shift capital expenditures**

  [Bar chart showing percentages]

  80% pupils agree that Shift capital expenditures is extremely important / important factor in adoption of a cloud environment. 18% says it neither important nor unimportant, and 3% says it unimportant.

- **Operational expenditures**
84% pupils agree that Operational expenditures are extremely important / important factor in adoption of a cloud environment. 11% says it neither important nor unimportant, and 4% says it unimportant factor.

6. Need for cost reductions/savings are necessary for your organization to move to a cloud environment?

86% respondents are confident that cost reduction/saving are necessary for their organization to move to a cloud environment.

4.8 Findings of Strategic analysis

Key questions:

1. Have the cloud vendor promised with the security of data, teacher and student’s intellectual property?

2. Does infrastructure and network have the capability to support cloud solutions in the future too?

3. If you choose a vendor and you are not satisfied with his services, can you change without difficulty?

4. As both models have their benefits which one will you go for and why?
5. Which cost model suits you?

Answers:

“Which type of cloud solution fits the structure of the instructional activities for your institution?”

“Once the staff members have developed the skills and experience for the cloud implementation and integration, they can move further to build internal private clouds for the whole distance learning unit, and eventually build a hybrid cloud. Mission-critical applications (including students’ personal and financial information) can reside in the private cloud, which will generally provide better control, security, and privacy protection. On the other hand, non-core IT applications (e.g., learning management systems, customer relation systems, instructional support systems) should be outsourced to the public cloud as much as possible”[32]. “The hybrid approach brings together the best of both the public and private cloud worlds. A phased implementation strategy is recommended to realize the evolution of the cloud” [31].

4.9 ASSESS AND SELECT CLOUD SPECIALIST ORGANIZATIONS UTILIZING NUMEROUS CRITERIA

Thethi (2009) proposes "four criteria: cloud stage development, innovation arrangement, operational arrangement, and geographic arrangement". Leong (2009) proposes that while cost, operational soundness, and the capacity to scale are imperative while picking a cloud specialist organization, every association likewise needs to consider how well the cloud arrangement suits its association's application design, how well it gives the level of client bolster required by the association, and how well it meets the association's administration level, security, protection, and consistence needs. "Associations should search for a cloud specialist organization who can give financially savvy engineering and an astounding client encounter" (Leong and Chamberlin, 2010). Leong and Chamberlin (2010) likewise propose weightings for particular assessment criteria, including capacity to execute and fulfillment of vision. Extra determination criteria ought to be made that will particularly address remove adapting needs. For instance, does the cloud specialist co-op have aptitude in supporting particular programming and learning administration frameworks? What are their evaluating models and permitting plans?
There is an assortment of cloud specialist organizations in the commercial center. Cautious assessment is expected to analyze these cloud specialist co-ops' abilities. The sole reason for doing assessment is to choose a cloud specialist co-op fulfilling particular separation taking in unit's necessities and requirements. Many cloud specialist co-ops have groups of engineers who can give altered administrations to meet the particular needs of their customers. Trappler (2010) offers various recommendations to enable clients to manage contract issues with cloud specialist organizations, including: the base levels required for every component of the administration, classifying the particular parameters and solutions for inability to meet those prerequisites. Different components like asserting the organization's responsibility for information put away on the specialist organization's framework and determining the establishment's rights to get it back are additionally investigated. Enumerating of the framework foundation and security norms to be kept up by the specialist co-op alongside the establishment's rights to review consistence; and determining the organization's rights and expenses to proceed or suspend utilizing the administration. Discussions among e-Learning framework overseers and specialists are required, to set up an arrangement of particular criteria for the determination and assessment of cloud specialist organizations. It may be ideal if existing proficient affiliations step up with regards to this respect.

4.9.1 Comparison between The traditional Learning and E-learning
E- Learning or electronic based learning delivers the digital content and provide a learner-oriented environment. Computer based training, internet-based learning, web-based training, and online learning are some other names[14]. E-learning underpins the virtual condition by utilizing new advances, for example, long range interpersonal communication and instructive discussion. E-Learning can be characterized a type of instruction utilizing innovation and electronic gadgets and in the more extensive web and web innovation [15]. In this table examination between customary learning and e – learning with the focus on the elements of learners needs in understanding to the future prerequisites is appeared.
Table 4.1: Traditional learning Vs. e – learning

<table>
<thead>
<tr>
<th>Features</th>
<th>Traditional Learning</th>
<th>E-Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning focus</td>
<td>Teacher-centric</td>
<td>Student-centric</td>
</tr>
<tr>
<td>Motivational Features</td>
<td>Inculcate the spirit of competition and in turn jealousy in learners</td>
<td>Create collaboration and cooperation spirit in learners.</td>
</tr>
<tr>
<td>Time and Place limit</td>
<td>Time period is fixed and the limitation is we have to adhere to it.</td>
<td>Time and place flexibility is given to the user.</td>
</tr>
<tr>
<td>How to Respond</td>
<td>Predefined responses</td>
<td>Multiple replies when confronted with the problem</td>
</tr>
<tr>
<td>Content compatibility</td>
<td>In the initial shape and remain unchanged</td>
<td>Change according to the users.</td>
</tr>
<tr>
<td>Educational prerequisites</td>
<td>Physical space for students and physical space for educational resources</td>
<td>Virtual space to save educational resources without the need of physical space to locate the students</td>
</tr>
<tr>
<td>Up to date Educational Resources</td>
<td>Fixed content and usually old</td>
<td>Dynamic content and usually updated</td>
</tr>
<tr>
<td>Forms of Educational Content</td>
<td>Educational content was one dimensional and focus was on Book.</td>
<td>Multiple learning content(audio, video, multimedia) and interactive.</td>
</tr>
</tbody>
</table>
Cloud support e-learning educational system and offer the low hardware cost and fast connectivity. Provide the services on demand with pay per use mechanism and accomplish the modern learning requirements.

In this table comparison of e – learning and cloud based e-learning with the spotlight on the characteristics of learning needs. According to the requirements, the contrast between both learning systems is illustrated.

**Table 4.2: Comparison of Traditional e – learning models and Cloud based e-learning models**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Common e- learning</th>
<th>E-learning based on Cloud Computing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware costs</td>
<td>High cost of maintenance</td>
<td>Low cost of Maintenance</td>
</tr>
<tr>
<td>Storage capacity</td>
<td>Fixed capacity</td>
<td>Dynamic capacity</td>
</tr>
<tr>
<td>Requires specialized Knowledge within the Enterprise</td>
<td>Use of E-learning Professionals</td>
<td>Using a computer Technician</td>
</tr>
<tr>
<td>Implementation period</td>
<td>Very long</td>
<td>Shorter than the common method</td>
</tr>
<tr>
<td>Processing Power</td>
<td>Initial and fixed</td>
<td>In terms of demand</td>
</tr>
<tr>
<td>Security, Trust and related issues</td>
<td>Internal maintenance, more security and trust</td>
<td>External maintenance, reduced security and trust</td>
</tr>
<tr>
<td>Overall costs</td>
<td>Initial investment, fixed and high</td>
<td>Pay-per-use</td>
</tr>
<tr>
<td>S.No.</td>
<td>Key Benefits of Cloud Based</td>
<td>Features</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>1.</td>
<td>Lower Cost Computer</td>
<td>To run a web application based on the cloud, it is enough to have systems with low memory, less processing power, minimum storage. So PC’s can be affordable for rural students and with poor financial background.</td>
</tr>
<tr>
<td>2.</td>
<td>Fewer maintenances issues</td>
<td>Less hardware installed, no specific software, however there will be fewer maintenance issues.</td>
</tr>
<tr>
<td>3.</td>
<td>Increased Computing Power</td>
<td>Cloud has more processing powers so it is very helpful for student’s research projects and others.</td>
</tr>
<tr>
<td>4.</td>
<td>Easier group teamwork</td>
<td>Multiple students and teachers can collaborate to perform the different tasks</td>
</tr>
<tr>
<td>5.</td>
<td>Latest Versions and software update</td>
<td>The Cloud always hosts the latest versions of the documents. So there is no danger of having an outdated version on the computer[18].</td>
</tr>
<tr>
<td>6.</td>
<td>Interoperability across devices</td>
<td>No need to install specific software when moving the data from PC to Mobile.</td>
</tr>
<tr>
<td>7.</td>
<td>Worldwide access to document</td>
<td>Students can access required document on the cloud from anywhere geographically.</td>
</tr>
<tr>
<td>8.</td>
<td>Multitenant usage</td>
<td>If students requiring a specific lecture and form a group and then access the lecture, the cost will be further reduced.</td>
</tr>
<tr>
<td>9.</td>
<td>Incentive for the usage</td>
<td>Teachers are not needed to invest anything. Still they will be getting incentives for every access of their lectures by the students.</td>
</tr>
<tr>
<td>10.</td>
<td>Better Storage Capacity</td>
<td>Cloud provide the better storage capacity as compared to other servers</td>
</tr>
<tr>
<td>11.</td>
<td>Availability, fault tolerance and recovery</td>
<td>To guarantee a permanent service (24x7) and to avoid net traffic overflow.</td>
</tr>
<tr>
<td>12.</td>
<td>High security</td>
<td>Data is stored intensively. Relying on one or</td>
</tr>
</tbody>
</table>
more data centre, the managers manage the unified data, allocate the resources, balance load, deploy the software, control security, and do the reliable real time monitoring, thus guarantee the users’ data security to the greatest possible degree[22].

| 13. | Scalability | Since the application is running on a server, the scalability is inherent to the system. SaaS server may support many Institutions. Therefore, as students or teachers’ need grows, the software performance will upgrade [23]. |
| 14. | Energy Efficiency | It is also important to reduce the electric charge by microprocessors with a lower energy consumption and adaptable to their use [10]. |
| 15. | Flexibility | Scale Infrastructure to investments. Cloud allows user to dynamically scale as demands fluctuate [24]. |

Table 4.4: Advantages of e-Learning Cloud Computing

<table>
<thead>
<tr>
<th>No.</th>
<th>Challenges for e-learning Cloud</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Accessing via Web</td>
<td>It implies an ease of access from anywhere, any time and any one can access the application, greater demand for Web Development skills.</td>
</tr>
<tr>
<td>2.</td>
<td>No Client side software</td>
<td>Since the framework development and upkeep are not situated in inside of Educational Institutions or undertakings, it has diminished many costs like establishment cost (as there is no establishment), support cost organization and server organization cost, add up to bring down possession cost, IT staff cost.</td>
</tr>
<tr>
<td>3.</td>
<td>SaaS server may support many educational institutions</td>
<td>Since this application is running on server side, scalability is inherent to the system. Even though the student usage grows, the software performance will not degrade [24].</td>
</tr>
<tr>
<td></td>
<td>All subscriber data are held on SaaS server.</td>
<td>Very high level of security is needed by SaaS provider in order to gain trust of and subscribers sophisticated multitenant software architecture. The subscriber data is distributed between many providers and it must be integrated in order to gain overview of business, higher demand for system and data integrators [10].</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5.</td>
<td>Virtualization</td>
<td>It makes conceivable the fast substitution of a traded off cloud found server without significant expenses or harms. It is anything but difficult to make a clone of a virtual machine so the cloud downtime is relied upon to decrease considerably [24].</td>
</tr>
<tr>
<td>6.</td>
<td>Centralization data storage</td>
<td>Losing a cloud customer is not any more a noteworthy episode while the primary piece of the applications and information is put away into the cloud so another customer can be associated quick. Envision what will happen if a tablet that stores the examination questions is stolen [10].</td>
</tr>
<tr>
<td>7</td>
<td>Performance and bandwidth cost</td>
<td>Cloud provides internet computing based services data traffic heaving with a very high bandwidth requirement. However use the fibre optic cable establish broadband network.</td>
</tr>
</tbody>
</table>

### 4.9.2 A cost-benefit analysis and validation

Money saving advantage investigation and approval of our examination work is given. As said in the past segment, by utilizing cloud-based E-learning execution expenses to prepare against the present E-learning, progressively decreases the measure of the upkeep by utilizing distributed computing framework and expanding efficiency will be conceivable .In this segment we attempt to make the aggregate benefit of markers. We executed two sorts of cloud arrangements utilizing unreservedly accessible cloud administrations for e-Learning that appeared in Chapter 5 and contrasted and the ordinary PC based E-learning. Advantages of executing E-learning cloud are exhibited against a typical sort of E-learning. And after that the approval ventures through the review by poll of 1250 specialists from the field of data innovation (with various scholarly degrees were performed and the outcomes is displayed in the graph).
4.9.2.1 Validation of results

Figure 4.2 Graph: Cost-effectiveness of e-learning based on cloud computing

In the accompanying segment, so as to demonstrate the cost-adequacy of e-learning in view of distributed computing (regarding all costs, life cycle, and so forth said in the past segment) the review utilizing a poll was intended for this reason have been finished. Figure 4.2 speaks to the consequences of the poll examination of correlation of two accessible methodologies. The information gathered is gone into Ms-Excel sheets and the Graphs are plotted with the assistance of MS-Excel.

Table 4.5: Cost-effectiveness of e-learning based on cloud computing

<table>
<thead>
<tr>
<th>No</th>
<th>Description of Cost Element</th>
<th>Traditional</th>
<th>Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fixed Cost (for 100)</td>
<td>2500000</td>
<td>500000</td>
</tr>
<tr>
<td>2</td>
<td>Running Cost(For 100)</td>
<td>75000</td>
<td>50000</td>
</tr>
</tbody>
</table>

Table 4.6: Cost Comparison between Traditional vs Cloud Computing environment (for 100 Terminals)

<table>
<thead>
<tr>
<th>No</th>
<th>Description of Cost Element (for 100 Terminals)</th>
<th>Traditional</th>
<th>Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description</td>
<td>Base Unit</td>
<td>Increment</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>1</td>
<td>The estimated cost for electricity to operate the computers and other equipment. 100 units (per Year)</td>
<td>120000</td>
<td>14400</td>
</tr>
<tr>
<td>2</td>
<td>The monthly fee for Internet access.</td>
<td>360000</td>
<td>50000</td>
</tr>
<tr>
<td>3</td>
<td>Approximate cost of depreciating hardware life, upgrading and installing hardware etc. (Annual Maintenance cost (AMC)– increasing year by year)</td>
<td>2,00,000</td>
<td>25000</td>
</tr>
<tr>
<td>4</td>
<td>Cost of Updating/Upgrading/Licensing the Software i.e. Windows OS, SQL Server, Antivirus etc.</td>
<td>1,00,000</td>
<td>25000</td>
</tr>
<tr>
<td>5</td>
<td>Network Infrastructure (for 100)</td>
<td>100,000</td>
<td>25000</td>
</tr>
<tr>
<td>6</td>
<td>Terminals to use cloud(for 100)</td>
<td>60000</td>
<td>20000</td>
</tr>
<tr>
<td>7</td>
<td>SERVERS (for 100)</td>
<td>3,72,000</td>
<td>45000</td>
</tr>
<tr>
<td>8</td>
<td>Cost of Annual Internet Access</td>
<td>360000</td>
<td>40000</td>
</tr>
<tr>
<td>9</td>
<td>Server Hosting (Windows Server 2012, CPU – 2, RAM – 10GB, Storage – 1TB, Data Transfer/month – 100GB)[7]</td>
<td>240000</td>
<td>30000</td>
</tr>
<tr>
<td>10</td>
<td>The estimated cost for electricity to operate the computers and other equipment.(for 10 units)</td>
<td>4000</td>
<td>800</td>
</tr>
</tbody>
</table>
Figure 4.3: Graph depicting Cost Comparison between Traditional Vs Cloud Computing Environment (for 100 Terminals)

Poll was set up in two gatherings of inquiries and answers, the principal gathering of inquiries identified with the attributes of the basic E-learning style and the second gathering of inquiries identified with the qualities of E-learning in light of distributed computing. Additionally specialists member in the exploration procedure were in four scholarly levels from Bachelor to doctoral that about 51 percent of these experts had Master's degree in data innovation building. At last subsequent to gathering the consequences of the survey, reaction midpoint for each of the inquiries in each segment was figured and the acquired outcome was introduced in the above diagram. As appeared in the above diagram, the consequences of the survey examination, mirrors the veracity of cases of low general expenses and high life span and capacity in a distributed computing based style. Obviously different outcomes can likewise be grabbed like that of including the low level of trust in the utilization of cloud-based innovations. Same subject can show bearings for future research that will be examined assist in the conclusion.

Findings

Traditional ComputingBased E-Learning
If you own your own university’s or college’s server, you have incurred some capital expenditure (e.g. cost of the server, hiring administration, and physical rent etc.) and recurrent operational expenditure (e.g. power and cooling, admin wages, software and hardware upgrades). This cost is almost constant regardless of whether the server is fully utilized or not. You are storing your files and data with other users with often conflicting objectives. The lack of isolation exposes you to the risk of security and poor performance.

- Fixed charges are paid regardless of how much of your bandwidth or Storage portion you actually use.
- The way you subscribed to storage is not 'automatic', i.e. if you need more storage you have to inform the administrator and then you wait for them to upgrade your subscription etc. Even if it seems like automatic, in almost all cases, there is some human system administrator doing at the back-end.

**Cloud Computing Based E-Learning** The cloud changes the story in many ways.

- You don't have to own the remote server. You can simply rent one off the shelf. The take here is that you have not only eliminated the cost of servers, hard disks, Power, UPS etc, but you have also greatly minimized the cost of installation of software and maintenance.

- What's more? You don't have to care about sharing your remote server or storage with others. Thanks to virtualization technology, you are very well isolated. The risk of security, privacy violations and performance violation is greatly minimized.

- And again, it is 'pay as you go or use'. You can rent a 3GB/1CPU server for less than Rs 5000 in India now using available Cloud resources.

- The icing on the cake is that you can initiate, modify and terminate your cloud subscription in an on-demand manner! The cloud is highly autonomous, powered by highly intelligent systems that allow end users to create, modify and terminate cloud servers with relative ease without any human intervention.

- Lastly, you are not limited to just storage. In the cloud, you can rent just about anything, from a large cluster of servers, block storage (or disk arrays), operating systems, software
development platforms, and to your favourite application software, etc. There are over a dozen cloud providers over the Internet.

Figure 4.4: Cloud Computing Challenges for E-Learning

Comprehensive Survey Table

In this table, the comprehensive survey on e-learning systems in cloud computing environment and researchers’ concepts, proposed models and some key points about e learning on cloud are discussed.

<table>
<thead>
<tr>
<th>Year</th>
<th>Author Name</th>
<th>Key points and proposed models</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>Mansi Et al.[14]</td>
<td>The objective of this paper is to provide educational environment which is based on reusing the existing web tools, techniques, and services to provide browser based application.</td>
</tr>
<tr>
<td>2016</td>
<td>Jackson Et al.[33]</td>
<td>This paper majorly assesses the cloud computing adoption, benefits and issues and integration concepts in an e-learning system in higher education.</td>
</tr>
<tr>
<td>2016</td>
<td>Arvind et al.</td>
<td>Conclude Open source cloud based E</td>
</tr>
<tr>
<td>Year</td>
<td>Authors</td>
<td>Title</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>2016</td>
<td>Chetan et al. [04]</td>
<td>This paper is based on survey Adoption of cloud computing in Education System</td>
</tr>
<tr>
<td>2015</td>
<td>Ghazal et al.[26]</td>
<td>Introduce different models and compare to traditional e_learning and cloud e_learning.</td>
</tr>
<tr>
<td>2015</td>
<td>Fekry et al. [30]</td>
<td>Investigated the issue of how Cloud computing technology can be employed in e Learning systems in the favor of higher education which have limited budget.</td>
</tr>
<tr>
<td>2015</td>
<td>IM Venkatesul et al.</td>
<td>The proposed algorithm for video encryption and decryption during streaming in cloud computing takes less time as compared with RC4 and MD5 with required level of security.</td>
</tr>
<tr>
<td>2015</td>
<td>Akilu et al.[070]</td>
<td>In this paper discussed the main components of e-learning platform and focussed specifically on advantages and limitations of such systems with regards to our tertiary institutions.</td>
</tr>
<tr>
<td>2015</td>
<td>Manjeet et al.[08]</td>
<td>The paper highlights the concept and services provided by Cloud Computing. This paper highlights the benefits of using cloud computing for e-learning and also focuses on Cloud Computing initiatives.</td>
</tr>
<tr>
<td>2015</td>
<td>Shipra et al.[23]</td>
<td>In this paper brief knowledge of e learning and computing will be given and how cloud computing will be used for the application of e learning systems with some issues and benefits of cloud computing.</td>
</tr>
<tr>
<td>2015</td>
<td>Zaydon et al.</td>
<td>The aim of this paper is to discuss the integration of cloud computing (service and deployment models) and e-learning to highlight the benefits and challenges of cloud computing for e-learning in the</td>
</tr>
<tr>
<td>Year</td>
<td>Authors</td>
<td>Reference</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>2014</td>
<td>Thanh Duy et al. [31]</td>
<td>With the theoretical exploration and integration of consumer innovativeness with the UTAUT2 antecedents into the same model, the paper proposes a model of E-learning adoption that explains the factors of influence on the consumer intention and use of cloud-based E-learning systems. The model was empirically tested and basically supported.</td>
</tr>
<tr>
<td>2014</td>
<td>Mohammed F et al. [29]</td>
<td>This paper provides the optimistic impact of using cloud computing architectures based on e-learning system development. It spotlights on the payback of cloud computing for e-learning solutions and the e-learning development organization confronts when this architecture is utilized.</td>
</tr>
<tr>
<td>2014</td>
<td>Santhi et al. [24]</td>
<td>In this paper, we have expressed the major components of e-Learning systems, focusing on the flexibility, accessibility, consistency and repeatability of this kind of systems.</td>
</tr>
<tr>
<td>2014</td>
<td>K.Yadav et al. [37]</td>
<td>In the present paper a cloud education system introduce how it is and it is beneficial for students, faculty and the beneficial for students, faculty and the educational institutes for providing quality education for.</td>
</tr>
<tr>
<td>2014</td>
<td>Shahriar et al. [15]</td>
<td>In this research at first the concept of a cloud computing based along with its benefits is introduced. Then, a new formula is suggested that showing the cost effectiveness of the cloud based e-learning.</td>
</tr>
</tbody>
</table>
| 2014 | Abhay et al. [12] | In this paper, discuss MVC framework which provides more efficiency, maintainability, reusability and separate functional layers hence most of the industries uses that for system
<table>
<thead>
<tr>
<th>Year</th>
<th>Author(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>M. Malathi</td>
<td>In this paper we introduced the proposed architecture based on the clouds. This model can be effectively used in schools of remote villages, in the distance education field, for online training of business professionals, for children who cannot attend schools and people from poor financial background.</td>
</tr>
<tr>
<td>2013</td>
<td>Chirag et al. [35]</td>
<td>This paper presented comprehensive study of different elearning LMS.</td>
</tr>
</tbody>
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