An Approach for Cloud Computing Environment as Solution Method to Aid E-Learning & Multimedia Training and Act as Cloud Disaster Recovery

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Summary
Cloud computing (CC) method is a new trend in tackling disconnected lead-time for a down internal information system(s), to avoid work devastation for education and training enterprise(s). A sudden halt of institutes' computerized services for an hour or many days can cause chaos and disrupt the vibrant affairs of administration procedure, faulty members as well as students' daily processes and the required updates on the organization's termly information. To depend on traditional disaster recovery methods to continue the business activities as usual and to reach the ultimate level of information retrieval abilities before the crash of computer system(s) seems as heave in the present time. Regular computer recovery servers could not accommodate such an operation owing to the staggering rise of student numbers, the demanding of computerized service on a variety of applications for faculty members, students and management electronic correspondent, due to cost overheads, inadequate financial plan and lack of in-house technical team. This lead to high demand on methodology with aid of cloud computing (CC) collaborative(s) to secure the effectiveness for many electronics & multimedia endeavor and act as disaster recovery (DR) plan for education and training institute(s).

Keywords:
Cloud computing, Down-lead-time, traditional disaster recovery methods, Cloud disaster recovery methods, E-learning, multimedia training

1. Introduction

Information and communication technologies became an essential part of any educational and training enterprises. The considerable demand on getting different types of information and data in a short time drives the need to modernize the way that the firm construct and maintain such high tech computerized system(s) within the organizational levels. This frame of work take on consideration competiveness with similar institutes over what is offer of application and programs on the internet, and to maintain their educational and training quality. Mata, et al. [1] mentioned the effect of high tech of the shape of future picture, which measures the level of development in information and data transfer in and out of this institutes to the outside world. However, Angeles, et al. [2] evaluated the usage of internet in the communications since the early beginnings of the twenty century. In addition, Aghdaie et al. [3] showed the growing demand on the usage of the internet in the twenty first century with regard to the substantial amount of data have been transferred via the internet. This shows the major influence of the internet as an efficient and most economical method to transfer and retrieve information and data in literally with no time.

Many studies focused on the role and relationship between the usages of the internet as technique to enhance education and training methods. Goodhue & Thompson [4] set out what had called 'Technology-to-Performance Chain Model'. This model stated that a gradual increase of technology should be accompanied by gaining higher training skills. In addition, Mukhopadhyay, et al. [5] and Li & Ye [6] studied the effect of information technology on improving organizational and managerial issues for education and financial institutes as well. However, Delic et al [7] used a knowledge cycles comprise of three factors. Firstly gaining information, then learning its contents, finally practicing knowledge throughout the organization to create knowledge enterprise formation.

Most contemporary institutes realized the importance of developing a high-tech information and communication systems to aid the process of education and training to overcome several learning difficulties and stay up-to-date with the fast growing needs market.

Although it is essential to enhance the institute's education and training performance in the way that using the most modern information technology system(s) connected to the internet, nevertheless the organization ought to develop a plan to protect the continuity of business without a major interruption(s). As a present tactic to solve, the problem of information and communications system(s) disruption is cloud-computing (CC) trend.

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2. Background and Study Stems

Cloud computing is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services), which can be rapidly provisioned and released with minimal management effort [8]. On the other hand, Vouk [9], terminology of cloud computing has a similarity with Wikipedia definitions, is the practice of storing regularly used computer data on multiple servers that can be accessed through the Internet is called cloud computing. IBM had modest term for cloud computing it is often referred to as simply "the cloud," is the delivery of on-demand computing resources—everything from applications to data centers—over the internet on a pay-for-use basis [10]. In addition, Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in either privately owned, or third party data centers that may be located far from the user–ranging in distance from across a city to across the world. Cloud computing relies on sharing of resources to achieve coherence and economy of scale, similar to a utility (like the electricity grid) over an electricity network [11]. It seems the IBM terminology much obvious to guide the idea of implementation of cloud computing structure in any firm(s).

In planning for a reliable methodology that safeguard future organization business continuity and services conveyed to too many end users, three factors ought to be studies as follows:

-Similar organization approaches.

-Organization available financial and technical capabilities.

-Type(s) and attitude(s) of information and communication services committed to convey the future change.

2.1 Cloud computing structure capabilities as DR approaches

"Inductive Method" used in this section to shed the light on many previous studies from the literature to act as a comparison technique to extract numerous benefits from past researches for the future study. Many experiences relative to this subject produced specific outcome(s). Khoshkholghi et al. [12] described the meaning of cloud computing as shifts data and computerized services from individual devices to distributed architectures. In addition described the types of cloud computing which are public, private, and hybrid clouds. Furthermore, Zhang [13], named the three levels of cloud-based services as follows:

- Infrastructure

- Software

- Platform

Khoshkholghi et al. elaborated on the issue of disaster recovery (DR) as an unexpected event in a system lifetime. This unexpected event can be from natural causes like earthquakes or manmade human error or sabotage. Regarding the issue of types of threats on information and communication systems, the 2016 Internet Security Threat Report by Symantec Corporation [14] conferring in 2015 a record-setting total of nine mega-breaches are reported and conservative estimate of unreported breaches pushes the number of records lost to more than half a billion. In addition to there are over one million web attacks against people every day.

Furthermore, between 2% to 4% of IT budget in large firms in expenditure for DR annually [15]. Even medium and small institutes can benefit from having a DR system. In addition to, disaster recovery system has three levels, data, system and application. These levels are concern of security, reducing recovery time and application continuity. For any DR system, there are many methods to build a recovery plan in cloud computing environment. Two approaches showed in literature according to Khoshkholghi et al. as follows:

- Redundancy plan: which is a strategy uses separated parallel sites with the capability to start up the application in case of disaster.

- Backup plan: a strategy depended on the use of a verity of replication technology, host and VM, database and storage.

The objectives of DR in cloud computing setting are to minimize the time of the crashed system(s) and to reduce the data lost during down time. The down time lost and the data vanished when the system stopped, this conclude the type of plan for recovery system strategy and tactics should be adhered by an organization. In addition to this study brought the attention to some challenges faces DR setups for cloud situations like dependency of data on service provider, minimizing many kinds of setting costs, increasing security against cyber assaults and building storage architecture..etc. Furthermore, the study proposed several DR techniques to tackle the different issues facing general cloud recovery. Some of these techniques are local backup at the same site, geographical backup redundancy setting in many several locations and intra-private cloud storage where data stored in three backup sites..etc.

In reference to the 2014, Annual Report of Disaster Recovery Preparedness Benchmark Survey [16] stated that many organizations today still struggle with assembling the skills, time or money to adequately plan and test their DR readiness and nearly 3 out of 4 firms are at risk of failing to recover from disaster/outage.

Furthermore, research survey over 400 world leading IT executives in the beginning of year 2015, which results, had published in IDG 2016 report disclosed that some organizations are already making the transition to Cloud Recovery strategies [17]. In addition to, according to VMWARE white paper, which revealed that, 100 of respondents have installed at present cloud-based DR within IT infrastructure, however 36% plot to go in the same direction within the next two years [18].

The new trend of evolving to disaster recovery strategy based on cloud computing is spreading among many organizations. However, what suite one it does not have to be the right solution to other(s). Nevertheless, educational institutes' needs differ than commercial ones. This study emphasizes on educational and training establishments to assess the renovation of IT arrangements with regard to cloud computing to meet the increasing demand from enrolled students, trainees and employees. There several cloud computing as a mean for DR experiences revealed in the literature that ought to be thoroughly analyzed, to guide any future transition plan to cloud computing as method to build a DR for an educational organization.

2.2 Previous Experiences

A study conducted as a survey over variety of Turkish sectors to screen the effect of cloud computing especially in the education sector showed that the schools and education services got 4 percent for cloud usage in different areas. This result disclosed that lots of work needed to encourage education and training organizations toward transition to cloud computing [19]. There are some available sources for cloud computing such as the work of Praveen & Betsy, which they had introduce a comprehensive overview to the application of cloud in universities [20].

Furthermore, this study [19] elaborated that the various service providers use different interfaces to their compute resources and utilizing varied architectures that created a management problem. Mitchell [21] outline current learning architectures and raised queries regarding how educational institutions are managing the cloud computing resources. Also produced some rational explanations for the challenge of indexing web resources for ultimate discoverability by students and lecturers. In the contrary, this study emphasizes that cloud-computing resources are available and becoming almost free, hence any education and training firms should take these benefits of this present paradigm to reduce technology budget and increase learning skills.

In addition, this study [19] provided a proposed model to implement a cloud-computing environment in an educational organization. The main elements of cloud-computing infrastructure services are administrative and academic staff, and students' needs. Furthermore, this model's IT resources used as needed, on what is called" pay-as-you-go" model (Figure 1).

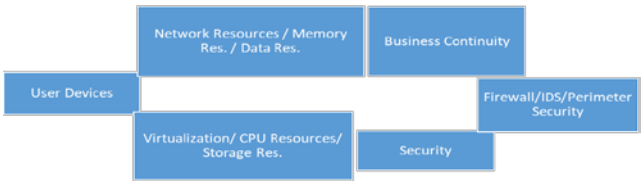

Fig. 1 Infrastructure Model

A research conducted on education system in Bangladesh to study the effect of cloud computing arrangement to improve educational skills on the emphasis of availability of information resources in the internet [22]. As an introduction to evaluate the cloud computing organization this study divided it to three elements with the method of use as follows:

- Software as a service (SAAS) - pay per use.

- Platform as a service (PAAS) – fee-based infrastructure with value-added application services.

- Infrastructure as a service (IAAS) – free services for vendors but sharing of revenues generated from consumer.

This study provided overview of Bangladesh education system in order to visualize the content of the interacting components to ease a proposed cloud computing structure for it. The analysis shows that although the government invested enormous budget to develop the education nevertheless the level learning below the expectations due to a variety of reasons.

To overcome the difficulties facing the Bangladesh education system this research displayed a proposed structure for cloud computing consist of local beneficiaries interacting with cloud central system. This arrangement allow the local service user pass the information requirements to the cloud system with prioritize precise time interval and forward those request after authentication as follows (Figure 2):

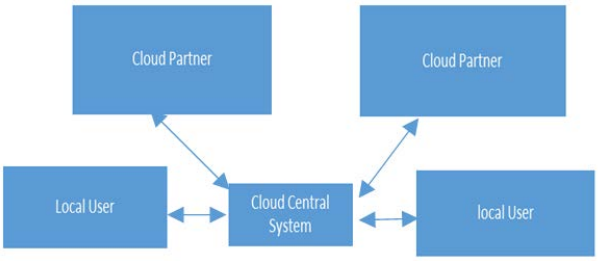

Fig. 2 Cloud Computing Architecture

This study also presented how the inter-relationship between the different layers of this proposed cloud-computing architecture, which best serve, the users and adheres to government regulations. Furthermore, this research reflected the outcome of past study on local hard disk failure carried out by Carnegin Mellon University, which found 2% - 4% failure rate and under certain conditions, this rate increased to 13%. Depending on the Carnegin Mellon University's research results, the proposed cloud computing architecture considered to store their data and information in Cloud Storage to avoid the problem of local disk failure and the loss of essential data, which act as DR plan for the education system.

In addition, this study stressed out some of difficulties facing the education system, which justify the use of cloud computing method to increase the students' learning abilities and academic staff's research performance, which overcome the drawbacks of existing education system.

A general case study of Latvia small and medium enterprises in various sectors focused on the benefits and challenges of introduction of cloud computing arrangement to their existing systems [23]. This research adopted Marston's segmentation of cloud computing concept that is a convergence of two main trends in IT field as follows:

1. IT efficiency, up-to-date computers with highly scalable hardware and software resources.

2. Business agility, flexibility of meeting customer demands with rapid deployment of new modern technology.

In addition, provided a research done by KPMG on deployment of cloud computing that resulted in business processes improvement and service automation as well as cost reduction. This point of view had shared with the educational and training sectors that emphasis on business continuity with the adaptation to this modern paradigm to reach the goal of cost reduction.

Even though this study referred to the various layers of cloud-computing architecture mentioned above, nevertheless it presented a preliminary approach to visualize how the concept of cloud computing might make significant effect on different aspects of an organization. The general similarity of presented concept gave an assist to the management of educational firms for future attempts. This research tended to divide the analysis of cloud computing deployment process into two parts as follows (Figure 3):

1. Dependent variable: The business perspectives of introducing cloud computing (CC) structure

2. Independent variables: there are three independent variables of concept CC

a. Awareness of usage and services

b. Impact and development of performance

c. Potential and future progress

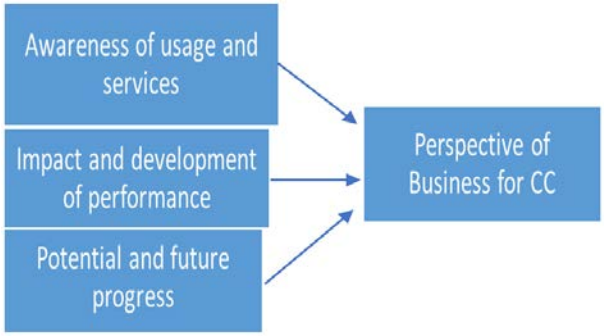

Fig. 3 Conceptual model of the research

This research used this conceptual model to prepare a survey to evaluate those independent variables to derive the actual perceptions of the require needs for the organization. The resemblance of those variables in the above approach, ought to be investigated on an educational organization since the general concern are the same?

Therefore, a survey conducted at many educational and training institutes of the Public Authority for Applied education and Training in Kuwait to investigate the previously set variable to probe the effect of cloud computing (CC) structure adaptation to their environment with the perception of the academic staff and management.

3. Research Survey

A survey had conducted on randomly selected academic and training staff from many educational and training institutes of the Public Authority for Applied education and Training in Kuwait. The population of the survey was 200 academic and training staff arbitrarily selected from

diverse institutes. For this task, the 'Descriptive Method' used thoroughly to analyze most of projected average calculations and the allowable estimate of redundancies regarding the variables used in this survey. The analytical investigation of the education and training management perspectives regarding the future subject of transition to cloud computing arrangement advantages and disadvantages. There are three important autonomous variables to guide this survey. Firstly, actual present state of needed IT technology, secondly effect of transition to implementation of cloud computing structure and finally future improvements to sustain quality of education and training for all participant in this organization.

Many factors considered for the population of this survey mainly variety of staff members, years of experience, job title and different IT training courses in the following tables:

Table 1: Variety of Staff Members

Institute Name	No. of participants	Average
Apprentice	24	12%
Management	20	10%
Industrial-1	24	12%
Leisure Industry	18	9%
Industrial-2	24	12%
Construction	24	12%
Energy	22	11%
Communication	24	12%
Nursing	20	10%
Total	200	100%

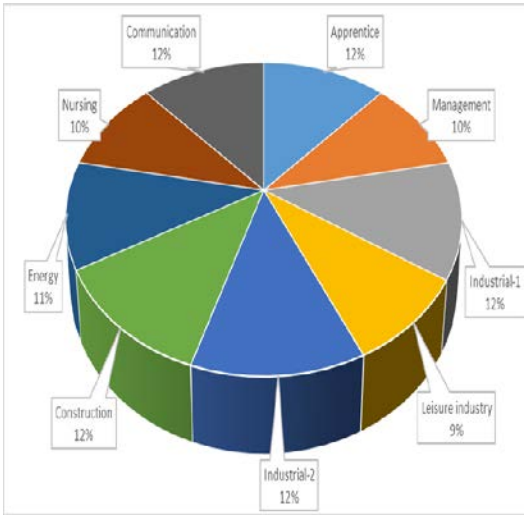

Fig. 4 Variety of Staff Members

Table 2: Years of Experience

Years of Experience	Number of Participants	Average
Less than 5	44	22%
Between 5-10	50	25%
Between 11-15	36	18%
16 years and over	70	35%
Total	200	100%

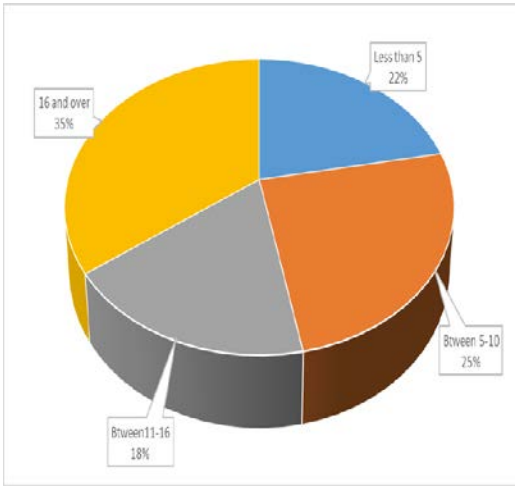

Fig. 5 Years of Experience

Table 3: Job Title

Job Title	No. of participants	Average
Assistant Trainer	38	19%
Trainer-B	46	23%
Trainer-A	36	18%
Lecturer-C	42	21%
Lecturer-B	24	12%
Lecturer-A	14	7%
Total	200	100%

Table (4) IT Training Courses

Attended Training Courses	No. of participants	Average
None	24	12%
One	58	29%
Two	36	18%
Three and over	82	41%
Total	200	100

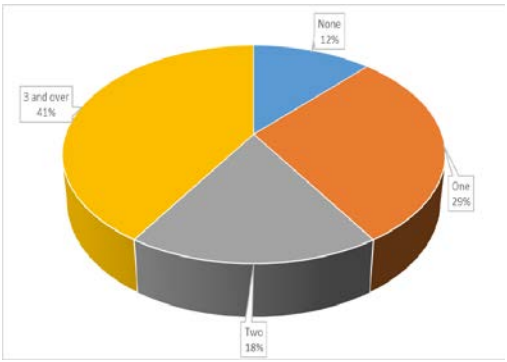

Fig. 6 IT Training courses

In a careful reading for the data of the survey's population shows that, although it had randomly selected nevertheless it covers a significant weight to be able to produce a consistent results. For example the average of the participants how attended IT training courses over 80% and over 70% average for the number of experienced participants.

The study survey analysis of the education and training institutes' management perceptions regarding the forthcoming objective of the transition to cloud computing infrastructure its impacts economically and technically over the various part of the organization. It had mentioned that there are three essential separate variables to monitor this survey. First, actual present state of needed IT technology, second, effect of transition to implementation of cloud computing structure and finally future awareness to sustain quality of education and training for all participant in this institute.

First variable - Actual present state of needed IT technology:

The analysis of the first variable, actual present state of needed IT technology calculations of weighing averages and allowable redundancies for eight evaluation questions for this part. Furthermore, depending on the percentage from the calculation of average means for each question that results in the prioritized the importance of the answers given. The following table shows the main questions calculations for this particular variable:

Table 5: Calculations of Mean Averages for first variable

Question*	I	II	III	IV	V	VI	VII
Mean Average	4.22	3.83	3.39	3.9	4.54	3.68	4.24
Rank Average	0.844	0.766	0.678	0.78	0.908	0.736	0.848
Percentage	84.4	75.6	67.8	78	90.8	73.6	84.8
Allowable Redundancy	31.18	24.23	18.11	24.38	31.26	22.57	33.42
Ranking Mean Averages	3	5	7	4	1	6	2
Overall Evaluation	Strong	Medium	Weak	Medium	Very Strong	Medium	Strong

Question*:

I: Active site on the internet for institute

II: Email service offered for all

III: Availability of training courses

IV: Availability of technical support

V: IT budget available

VI: Smart buildings readiness

VII: Internet service availability

The mean averages for the first variable shows that although IT budget availability was ranking number one followed by the availability of internet services, nevertheless the technical experience and support needed to enhance the participant fall short of expectations. The result for the first variable, point out real weaknesses within the staff abilities to handle significant IT challenges in future and management ought to prepare a good plan to treat this issue and improve staff IT skills.

Second variable - Effect of transition to implementation of cloud computing structure

Similar considerations used to calculate the results of questions for this variable to sustain the coherence of values for the integrity of results. The calculation projected in the following table:

Table 6: Calculations of Mean Averages for second variable

Question*	I	II	III	IV	V	VI	VII
Mean Average	4.62	4.52	4.55	4.47	3.34	4.46	4.49
Rank Average	0.924	0.904	0.91	0.894	0.868	0.892	0.898
Percentage	92.4	90.4	91.00	89.4	86.8	89.2	89.8
Allowable Redundancy	37.33	36.16	36.68	33.3	31.21	35.24	35.00
Ranking Mean Averages	1	3	2	5	7	6	4
Overall Evaluation	Strong	Very Strong	Very Strong	Strong	Strong	Strong	Strong

Question*:

I: Save time and effort

II: Speed and accuracy

III: Future improvements

IV: Improve efficiency

V: Support learning processes

VI: Support Management

VII: Accessibility of information

The results of this data produce a clear and crisp vision for the requirement of deployment of some sort of infrastructure for cloud computing arrangement for this organization that suit their future needs. This obvious from the first three questions' results that strongly support the transition to this contemporary concept for the benefit of the organization future. In same manner the rest of the questions' outcomes indicate a great momentum to boost the forthcoming learning improvements for the academic staff and students as well as to ease management procedures.

Third variable - future awareness to sustain quality of education and training for all participant in this institute

The third variable investigation follows the exact method of calculations for the past two variables to maintain the continuality of the outcomes similarity for the reliability for this part of the research in the following table:

Table 7: Calculations of Mean Averages for third variable

Question*	I	II	III	IV	V	VI
Mean Average	4.34	4.12	3.89	4.27	3.94	4.46
Rank Average	0.916	0.896	0.932	0.948	0.858	0.892
Percentage	91.6	89.6	93.2	94.8	85.8	89.2
Allowable Redundancy	34.32	30.16	33.78	36.33	30.21	35.24
Ranking Mean Averages	2	4	7	3	6	6
Overall Evaluation	Very Strong	Strong	Very Strong	Strong	Strong	Strong

Question*:

I: Increase IT budget

II: IT training

III: Technical support center

IV: Smart Building readiness

V: E-learning education

VI: Smart Management

The outcomes of this variable show a huge obligation toward the transformation to the cloud-computing environment that aid the development of whole education and training processes and procedures for the benefit for all participants of these institutes especially the enhancement of the academic skills to stay competitive with other counterpart in this fast changing world.

Based on consequences of the outcomes of the survey and combined with analysis of pasted cloud computing experiences from literature, therefore this research is inclined to set up a model to assist toward development of cloud computing(CC) structure for the organization that best fit its requirements to improve both institutes' management work and increase education and training academic abilities.

4. Proposed CC Model

The analysis of the survey's results showed that in order to enhance the capabilities of the institutes' members as well as to improve all over of the aspects of the organization, a transition stage had to be encountered to cloud computing (CC) paradigm. This step is becoming an essential part toward the future of handling variety of data and applications for these entities without suffering of losing an important information.

To perform a detailed analysis to aid the management of the organization to transform to cloud computing infrastructure a methodology consist of three stages and three tangible and non-tangible factors with six sub-factors and a hybrid technique with three different layers as follows:

Stage 1: This is a groundwork stage takes place to prepare for the detailed investigation of the different factors involved in the assessment of transformation into cloud computing environment. The information and communication plan ought to have three entities, first clear top management strategy to guide the organization forthcoming modern technology. Second, a well-defined and separate information technology (IT) budget capable of implementing and maintaining the contemporary trend. Finally, a real and a suitable action plans distributed to the organization team responsible for enforcing new technology.

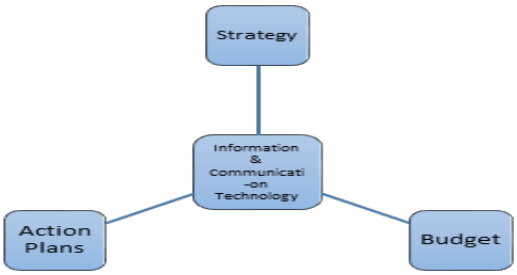

Fig. 7 Information & Communication Technology

Stage 2: A special top management team responsible of classifying the sub-factors showed below in figure (8). This categorization step is essential for the business overall to define what are necessary needed actions that are to fit together to complete the long-run modern technology plan to create the cloud computing institute's structure.

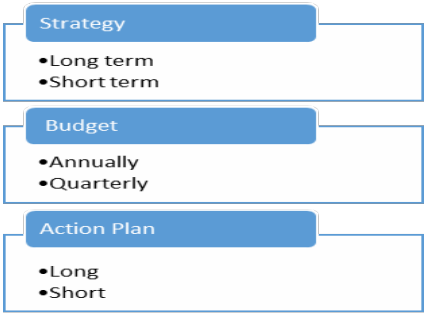

Fig. 8 Categorization of Information & Communication Plan

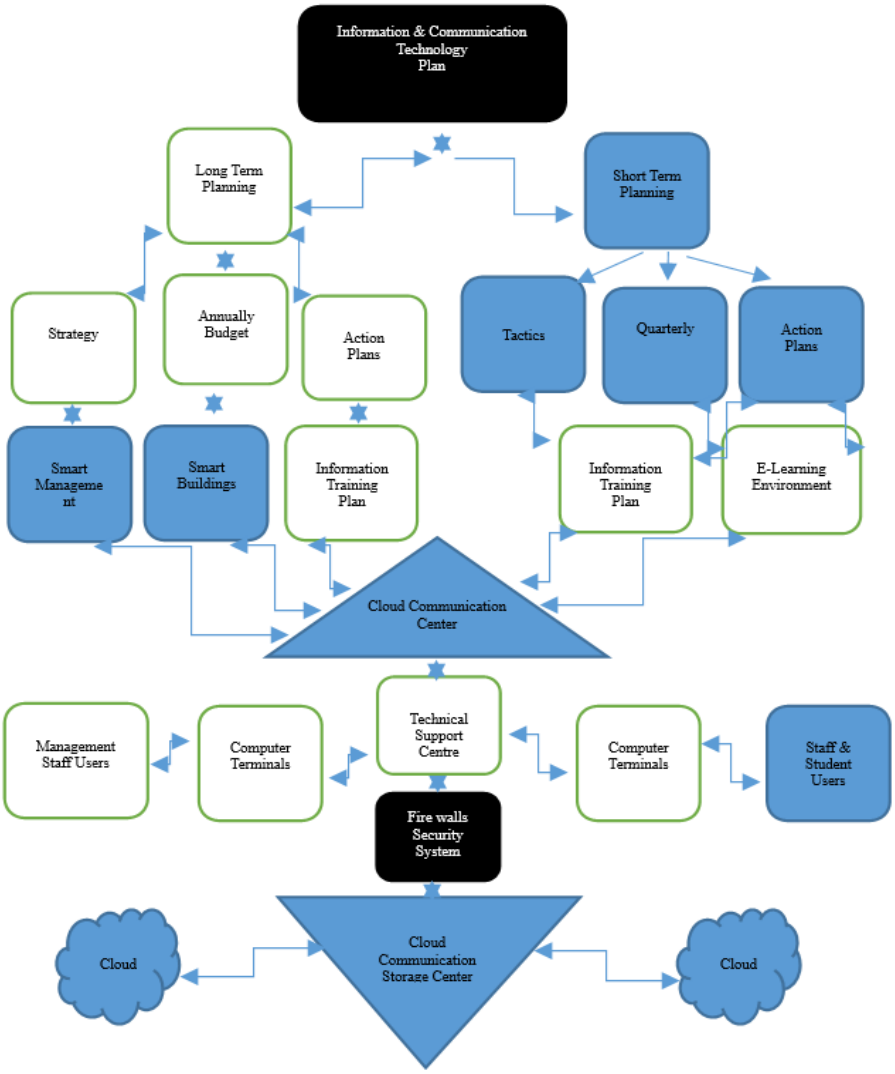

Fig. 9 a hybrid technique with three layers

Stage 3: In this stage an interconnection between three multiple layers shown in figure (9) above. After a well-defined of the organization's Information and communication technology units into the first two stages of this methodology. The last step is the commissioning of a hybrid technique with three layers interacting together to shift the work processes into cloud computing environment.

The main core of this stage is the cloud communication structure/layer with focal role to regulate the incoming request of information from the institutes' participant and the storage of filtered data received via a cloud partnerships.

The arrangement of the second layer composed of the indispensable short tactics that are responsible of quarterly progress of the action plans and improvement of staff skills needed to carry out the forthcoming new trend. Furthermore, it coincides between the set plans from top management in comparison with what had received from cloud applications regarding following up the improvement of education and training methods and services for the institutes.

The outer shell of this technique is the longer vision parts for the organization's plan in the road to complete the total transformation into the cloud-computing infrastructure using its capabilities to act as disaster recovery in case of interruption of the firm's in-house systems. The feedback information through the interrelating with the cloud applications result in the adjustments needed to improve the performance of overall organization plans.

The three layers of this technique describe clearly the relationships between the institute requirements to perform better with the new technology that is the cloud-computing trend and act as a disaster recovery technique.

5. Conclusion

The emphasis on new computer technologies is a fast track path that evolve rapidly carrying out major changes in treating competently a variety of business problems. In this research, an approach developed to encounter many financial and technical difficulties facing contemporary institutes. Furthermore, it carefully created an environment for interrelationships among three layers of dependable/undependable factors/parts needed to guide the path to the new information technology era. The cloud computing method, seems attractive for the benefits gained from its services, nevertheless this structure faces also worries regarding for example the information security. In addition, this approach defines the role of cloud computing as a disaster recovery plan to secure the continuity of business processes.

Future testing of this hybrid technique is essential to assess the relationships performance of the hybrid technique layers. In addition, the importance of the core layer in protecting the data and information passing through it from organization's entities to cloud collaborates a testing of its integrity required to define the level of security and the amount of necessary information storage needed in case of emergencies.

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