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The Impact of Cloud Computing In Developing Countries- A Case Study of Ghana

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ABSTRACT

In today's world, technology is driving the flow of change in everything. The advancement in Information and Communication Technology and the increasing demand for it is associated with high cost of resource utilization. Several organizations are making efforts to minimize the cost of computing via the means of virtualization. The response to diminish the cost of computing has brought about the development of Cloud Computing (CC). In cloud computing, administration, better-quality utilization and cost of infrastructure are reduced by providing services as pay per usage.As a service, CC is having enormous effects that are very crucial and inevitable towards the development of developing countries that want to survive in the highly competitive world. Concentration of cloud–related accomplishments is mainly in vast markets in countries such as Vietnam, South Africa, India, Brazil and China. Such does not dispute the fact that, the cloud is progressively making an intrusion into miniature markets like Ghana and other countries. This research provided the effects of cloud computing on developing countries and the possible future prospects. One vital benefit developing countries will derive from this adoption is that they will not only capitalize on value-added service delivery, but also enhance efficiency with maximized productivity.
Keywords: on-demand, configurable computing resource, virtualization, bandwidth, cloud computing, outsourcing.

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INTRODUCTION

Cloud Computing is emerging more rapidly and among the most promising interdisciplinary and business fields leading to a higher patronage in the world over today. Cloud computing in the internet sense is a web-centered computing service, whereby several and more complicated resources, information, and software are provided largely on-demand through the World Wide Web.

In computer networks, the term Cloud is seen as sharing on demand and a corporate model which package new technologies that include server virtualization which makes a positive gain in scaling instability economies and multi-tenancy to lessen the cost of using information and technological properties. The cloud has become a symbol for the Internet and it is an idea that covers wide complex infrastructural set-ups. Major important points can be extracted from the definition on the subject of cloud computing. How cloud computing differs from traditional computing paradigms is that of scalability, it can be put in a nutshell as an abstract entity which provides distinctive levels of services to the end-users, hammered by economies of scale and again these services can be dynamically configurable as Foster et al., 2008, puts it.

As enterprises become entrenched and grow, information technology is something that cannot be done away with and is an optimistic foreseeable key success factor in the operation of the business, thus organizations can produce, interconnect and join forces faster and much better, more efficient and consistent than ever before. John McCarthy, a computer scientist in the 1960s presented the idea of utility computing into the world of technology, predicting that the series of stages of technology will not always remain as perceptible creations. He leaned on the increase of theories to guess that computer resources will be provided like utilities such as water and electricity – probably as a service (McCarthy, 1961).

Network services have existed right from the invention and operation of the internet in the 1970's (Martin, 2003). The society was already able to login from a distant place, relocate files between centers via the FTP protocols in the initial ages of the internet. However, in the last couple of years, internet activities that were offered online took on a novel approach. Motahari-Nezhad et al (2009) opines that, software, including big fast machines own by another is now capable of being offered online which runs an application that can be accessed using a web browser that the person is accustomed to, although the application for the most part belongs to someone else.

A lot of companies have capitalized on the existence of cloud computing technology by constructing their own public clouds, such as Picnic, Adobe Photoshop Express, Google Doc and Microsoft. These companies as and when the need arise releases new descriptions and updates of their services. In Ghana, we have governmental agencies like GhiPSS that offer POS services and other private enterprises like EBIT and Temenos Connect (ARC Mobile) that also invest cloud computing technology. In the telecommunication industry, several players are also engaged in cloud computing services such as MTN Ghana, Vodafone Ghana, and Tigo Ghana.

As a matter of fact, the prospect we can enjoy from using cloud design to develop applications are very enormous. Individuals and enterprises can enjoy real value from mass computing and storage capacities made available by these large, medium and small- sized enterprises that have stable, vibrant and strong cloud structural design. Apparently, companies that are longing to increase their future margin of success can make use of virtualization, build massive accessible environments, and explore cloud computing provisions to enhance their future prospect.

Developing countries can as well take advantage from its cost, flexibility, convenience and accessibility in terms of E-health, E-commerce and E-education. According to Lynch, (2008), estimates of the cost advantages involved in cloud computing is between three and five times for business applications and over five times for consumer applications. As it is with the case of Lynch, in Ghana, it is not quite different. Native enterprises engage more consumer applications than business applications and cloud computing is in the lead with the most important services being mobile banking applications and mobile phone services. Gartner press release, (2008), discusses that cloud computing in the nearby future will have maximum influence than e- business.

1.1 Problem Statement

Since cloud computing is everywhere and it is the emerging solutions to cost, virtualization and hardware use, resources sharing and greatly contributing to E-health, E-commerce and E- education (Kshetri, 2010), We seek to find the positive and negative consequences of cloud computing in developing countries. One of the major problems associated with developing countries is how efficient the cloud services (whether in terms of software, platform or infrastructure) are being utilized.

Even though there are some cloud services in developing countries, they are offered by enterprises of foreign origin such as Microsoft, Yahoo, Amazon and Google, but how resourceful or proficient they are to both the providers and consumers is what matters most. Quite a few are locally hosted. We thereby seek to find answers to these questions:

- how does users and enterprises gain from cloud computing in terms of cost?
- is there availability of the cloud services to developing countries like Ghana?
- is it attractive to the computing market of the developing countries?
- do people patronize access to data and application from the cloud?
- does the country have local companies that have infrastructural resources to host the cloud?
- how secure cloud computing is in terms of data loss and recovery in developing countries?
- how efficiently are these concepts explored in the developing world?

1.2 Objectives of the Study

The purpose of the study is to find the impact of cloud computing in developing countries. This involves the benefits and drawbacks with regard to cloud computing cost, service attractiveness, data security, and patronage and service availability in developing countries.

The specific objectives are to:

Find out what users and enterprises gain from cloud computing in terms of cost.
Find out whether there is availability of the cloud services to developing countries like Ghana.
Find out how attractive cloud computing is to the computing market of the developing countries
Find out how secured cloud computing is in terms of data loss and recovery in developing countries.

1.3 Scope and Limitation of the Study

Geographically, the emphasis of this study is on developing countries specifically in Ghana as a developing country. This paper covered the activities of people in five institutions and 15 individuals with IT knowledge in Ashanti Region. These institutions in Ashanti are GCB Bank Ltd., Odotobri Rural Bank Ltd., St. Martin De Pores Co-operative Savings and Loans Ltd., Ghana National Service Scheme and Amansie West Rural Bank Ltd.

Among the various limitations, the following were of critical attention: time factor to finish the write-up, inadequate funds to pay field assistants to assist in data collection across the ten regions of Ghana, inadequate knowledge on the part of respondents on the subject matter leading to their unwillingness to answer the questionnaire, inadequacy of people with professional knowledge on cloud computing to give appropriate responses to the questionnaire and inadequate literature or novels on the topic under review.

2. LITERATURE REVIEW

In today's extremely competitive business locations, enterprises find ways and means to operate efficiently so that they can cut down cost and capitalize on huge gains. Cloud computing which is a new paradigm of computing has materialized to amend the primitive ways of computing. As simple as Mell &Grance (2011) put it, cloud computing has begun as one of the empowering technologies that allows the effective and more efficient use of computer resource in the Information Technology world. With this advancement in efficient operation and cutting down cost comes a huge potential which enterprises and governments in the developing world need to utilize to improve service delivery and performance in various facets of governments and private businesses.

With its ubiquitous nature, the substantial benefits of cloud computing have far been reaped in the advanced world than in developing countries. Mathias and Baldreck (2011), asserts that, cloud computing brings services like software, computation, data access, and storage to end-users, to make use of, which they practically do not need to know the exact physical location and configuration of the system that delivers the services. Several benefits of cloud computing have been identified but Bakshi & Hemachandran (2011) stresses majorly on faster provisioning of systems and applications, cut down cost and consumption model, ease of integration, highly secure infrastructure, right-size to address business changes, and compatible facilities and procedures.

In spite of these benefits, there are various challenges as well that may hinder the implementation of cloud computing in developing countries. This paper begins by defining cloud computing, briefly discusses deployment and delivery models, and intensely discuss benefits that come with adopting cloud computing and security risks involved in its adoption.

2.1 Definitions of Cloud Computing

The term cloud computing is a notion which simply represents the internet or a large area that is connected to each other. "*Cloud computing is a model of delivering a range of IT services remotely through the Internet and/or a networked IT environment*" (Sultan 2013). From Vaquero et al. 2008, Vouk (2008) point of view, the term cloud is figurative and points to a large team of usable assets such as hardware and software that can be easily accessed through the web. Rabi et al (2011), defines cloud computing in such a way that it is pictured as a disseminated architecture that centralizes server resources on a scalable platform so that users can be provided with on demand computing resources and services.

According to Vaquero, Rodero-Merino, and Buyya (2011), these services are also dynamically scalable, provided quickly (Zhang, Cheng, and Boutaba 2010), virtualized and deployed with minimal service provider involvement. The NIST (2011) defines cloud computing as "*a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.*" This distinctness from NIST (2011) by far and wide seems to become the most established definition.

Irrespective of what many researchers have done concerning cloud computing, not much has been expressed about the consequence of cloud computing in developing countries, and even less about outcomes resulting from such effects. Buying to their opinion, it is unclear to define cloud computing to suit all aspects of it service delivery which differs from other concepts like grid and cluster computing.

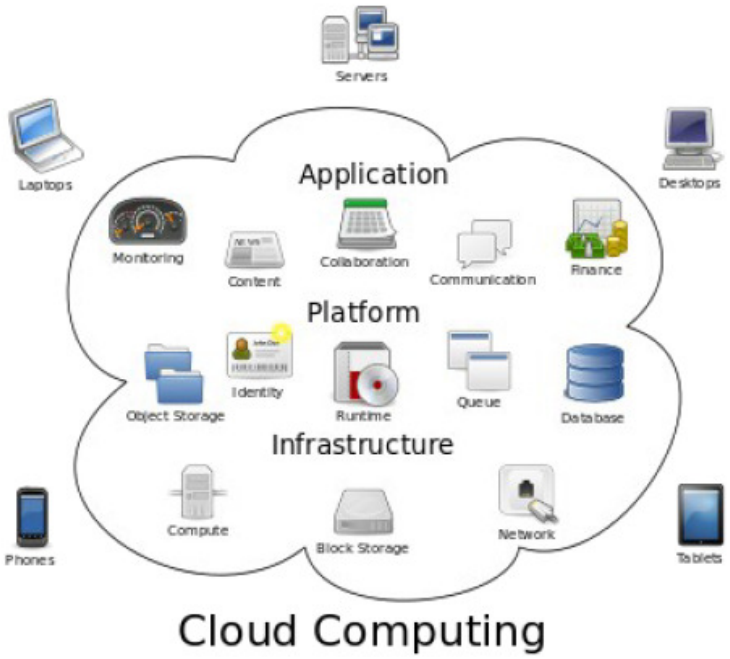

Figure 2.1: Cloud Computing as illustrated by Wikipedia

2.2 Cloud Computing in Developing Countries

The efficiency in cost warranted by cloud computing has generated higher growth in the cloud, but the problem of data security remains a severe delinquency. Capobianco (2010) arouse our sense to the definition of cloud computing to the extent that, even mobile devices that access the internet also participate in mobile cloud computing, since the devices need to borrow computing power and storage capacities from the cloud because they are one way or the other limited in resources. Using mobile phones to access the cloud seems to make sense to the developing world because it is the most common device and ready available as most cloud enterprises have already had their applications installed on these devices. In spite of these, there has been numerous efforts by various governments and the private institutions in the developing economies to help meet the IT needs of cloud computing.

According to Kshetri (2010), South Africa's Integer8 carry out operations in countries like Ghana, Kenya, and Nigeria and plans to expand to other African countries, where it will offer cloud and other services like email archiving, maintenance and continuity, off-site back, fax to email as well as video conferencing. Other private corporations have also embarked on key initiatives to get cloud computing services to the threshold of organisations in different operating environments. MTN Africa in 2012 launched a pilot cloud project targeting small and medium-sized enterprises in six African countries namely: Ghana, Cameroun, Cote D'Ivoire, Nigeria, Uganda and South Africa, as recounted by Ventures Africa (2012). A greater achievement as cloud computing emerges in Africa has been the Africa Cloud eXchange (ACX) instituted by one of South Africa's leading IT service provider called Teraco. Kwofie (2013) reports that, ACX will provide access to a vendor-neutral co-location space for sharing and selling cloud services. Kwofie (2013) conveys that, the cloud exchange will provide secure data undersea cables offering a combined twenty-eight (28) landing points across the eastern and the western coast of Africa together with all major carriers operating in South Africa and several active cloud providers.

It is hoped that the Africa Cloud eXchange will provide international access and cloud services for other African countries which will include Ghana, thereby making South Africa the central hub. Free peering, cost-effective and interconnect, access to all major carriers, resilient power, remote support and high security levels as the product offered by Teraco is the ideal space for cloud to be established in Africa. In Ghana, CPSs has created the awareness that have seen a rise in SMEs adoption in cloud computing. There is the need to face, uphold and address the confrontations, security and legal issues (Kwofie 2013) that the SMEs face since it is visibly clear from the above that, the rate of interest in cloud adoption in Ghana has increase.

2.3 Cloud Computing impacts in Developing Countries

Several researches have of late spoken on the impact of cloud computing in the developing world. In an extract from a publication by the Information Economy Report (Released by UNCTAD) states that, the level of the adoption of the cloud is significantly very low in developing countries. But, irrespective of how low it is, it is the right time to put into regard the chances and drawbacks the growing cloud family may carry to developing markets. The perspective is quite different between developing countries as well as types of service customers they have. The ability for cloud to seize opportunities and to avoid dangers associated with it will to a large extent, depend on the level of willingness of cloud, above all, in terms of broadband connectivity together with appropriate regulatory and legal framework.

Several positive impacts that can be explored here if Ghana government and other private enterprises in the country are to adopt Cloud Computing are as follows:

2.3.1 Virtualization

Virtualization involves the use of software to separate physical computing infrastructure to build various resources. It is a method of logically dividing the computer resources for different applications. In virtualization technology, a number of operating systems and applications can be run on the same server at a go. Virtualization serves as one of the basic features of cloud computing which makes the functioning of the cloud very active. It renders the cloud as virtual machines (VMs) in the idea of generalization of physical resources. The instant generation, storage, migration and / or termination of VMs invariably render the cloud computing very elastic and a reliable resource.One advantage of application virtualization is that, it ensures the smooth performance of the cloud, ensuring that the applications do not run at variance with each other. In server virtualization, it is based on the elementary principles of the cloud which allocates certain space based on their request and space availability in the infrastructure that is shared to the end users.

2.3.2 Flexibility and Convenience

To the Information Economy Report 2013, (released by UNCTAD), flexible right of entry to processing and storage capacity is another driver that cannot be left insignificant, predominantly for enterprises whose business activities hangs on seasons, and differ in computing requirements considerably at different stages of a business cycle, or which function in areas where demand is not predictable.Equally in private and public enterprises, cloud computing does not hold employees to be more rigid whether in the workplace or not. Using web-enabled devices like laptops, notebooks or even smart-phones, staff of enterprises can have access to multiple files. Since people can simultaneously share documents and other files over the internet, there is support for both internal and external partnership.

2.3.3 On-Demand

This service of the cloud makes provision for cloud users to have the services or resources they desire whenever they request for. It is always available when requested, needed or required. Due to the pay-as-you-go based on-demand / utility computing, it will help diminish expenditure on capital with respect to hardware and software authorizations. This feature is one of the major positions that ensure that, cloud computing is different from grid computing and cluster computing. As NIST has defined cloud computing, Mell and Grance (2009, 2011), it is a model for making a suitable, upon request network access to a shared assembly of computing resources that are configurable (e.g. networks, servers, storage,

applications, and services).This can be rapidly provided and deployed with little management efforts or service provider dealings.

2.3.4 Scalability and Elasticity

A key benefit we derive from the cloud is economies of scale. When your business is affiliated to the cloud, IT requirements can easily be scaled up or down as and when required. For example, nearly every cloud service provider will consent to you increasing your existing resources to lodge the increasing business needs. The cloud has a great deal of scalability. This means you can reach the resources you need as requirements changes. One thing to note is that, cost transparency gives the user reliable bases for planning, pay per use ensure that you only pay for the services you actually use.

2.3.5 Data Recovery

In the event of unexpected shutdown of IT infrastructure, there can be loss of data. Data recovery means retrieving inaccessible data from a corrupted or damaged drive. Data recovery in conventional set-up requires dedicated, precise hardware for storing data and distant application operations (Coombe, 2009). This in effect has its own drawbacks as it is time consuming. On the other hand, with the cloud, particularly the Infrastructure-as-a-Service (IaaS) platform, efficient and instantaneous back-up and recovery of data is promising (Chandran & Angepat, 2010).
Harish Vepuri and Moshin Rahman (2011) add that, the instant recovery of data in the cloud is the main duty of cloud providers who on the normal scale have built-in disaster recovery and back-up sites. Moreover, because cloud service providers make copies of their data, the occurrence of loss of one or more data centers will not result in the loss of entire data (Smyth, 2009).

3. METHODOLOGY

3.1 Research Design

This research adopts the exploratory approach this is entrenched on a flexible research design that provides opportunity for considering many different phases of a problem which is considered suitable if the purpose of the research study is that of exploration. This research particularly aimed to ascertain the benefits associated with cloud computing in developing countries, the associated security issues, and progresses towards overcoming the issues. This subsequently, helped in identifying the reasons for adopting cloud computing in developing countries.

3.2 Population

Looking at the research or study in question, it deals with vast number of people as the population of the study, since there is a large number of IT services consumers. In this study, the population size is 600 people and these include those who are in the IT environment. This paper covered the activities of people in five institutions and 15 individuals with IT knowledge within Ashanti Region in Ghana.

3.3 Sample and Sampling procedure

A sample size of 60 persons of whom 40 are IT experts, 5 managers and 15 individuals with IT knowledge or use mobile phones or some form of computing device. The notion for this decision was based on the consideration of resources constraints and limited time factor. This research used both purposive and random sampling for selecting participants for the study. These 60 persons sampled were out of the fact that, they are in key positions with explicit knowledge or some form of IT skills on the subject matter.

3.4 Data Collection Instruments and Procedure

To solicit views from the managers, IT experts and individuals, a guided interview was conducted which comprises questions on the objectives of the study. This paper used close-ended questionnaires to enable the respondents to have a clear view about the issue under study. A brief description of the questionnaires and interview were carried out to show the essence of it. Some of the areas about which we collected the data include: respondent knowledge in IT; respondent perception of the cloud; Company's willingness for the cloud; Company's effort towards the adoption; Models Company is

adopting; services/process the Company wants to deploy; benefits users or Company desire; main concerns towards the cloud; expertise respondents or companies wants from the cloud.

This was done to ensure that the test items were set at the appropriate levels of the sample and that the items had the desired content validity. The test items were made up of multiple-choice, dichotomous (Yes or No). This type of test item was chosen to reduce the effect of too much subjectivity in scoring. The test items were scrutinized by experts in IT. To ascertain the reliability of the instrument used for the research, pre- testing was carried out at the Bekwai Municipal Educational Management Information System Department. This department was chosen because they are the hub for information collection and management at Ghana Education Service, Bekwai Municipal Directorate and so, was of interest to the researchers.

4. DATA ANALYSIS AND PRESENTATION

In this chapter, we presented the analysis and interpretation of results from the study area.
A population size of 600 was chosen out of which 60 was considered as the sample size and this is illustrated in the table below:

RESPONDENTS	TOTAL NUMBER	SAMPLE SIZE	SAMPLING METHOD
IT Experts	400	40	Purposive sampling
Managers	50	5	Purposive sampling
Individuals	150	15	Random sampling
TOTAL	**600**	**60**	

Table 4.1 Sample and sampling method

In percentage distribution, 8.33% were managers, 66.67% were IT experts and 25.00% were individuals.

4.1 Data Analysis

4.1.1 Usage of ICT Tools

Among those institutions and individual visited, all had knowledge in ICT tools and were using ICT tools in communication. This show the level and pace at which the country is growing in ICT and adapting to the cloud services but in a gradual process. The responses indicated that in percentages wise, all categories went for YES while none opted for NO or DON'T KNOW.

4.2 Kind of ICT Tools

In the survey, it was revealed that, several computing devices were used by respondents. Among them were PCs, PDAs, Tablets, POS and Mobile Phones. Much of them were mobile phone usage and especially by the individuals to access the cloud while the institutions accessed their cloud services on PCs. The figure illustrated below depicts the mostly used device across the categories of the sampled population.

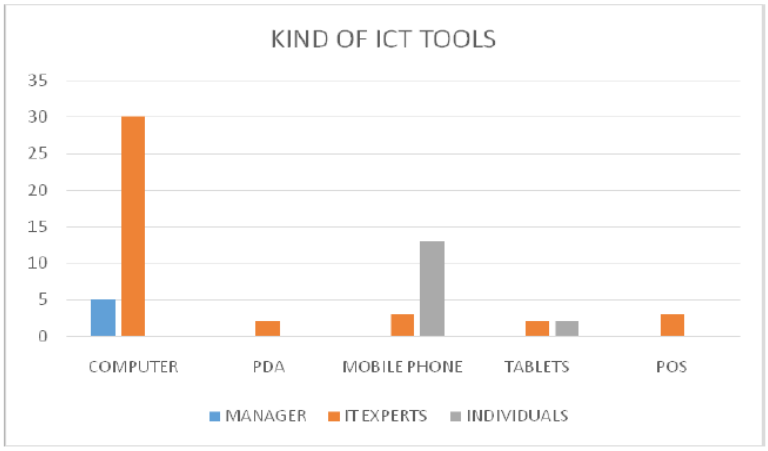

Figure 4: Kind of ICT Tools

4.3 Current State of Cloud Computing

Here, managers, IT experts and individuals were accessed through the questionnaires and interview to determine their general idea about cloud computing and its services. The managers seem to have quite a good knowledge about cloud computing, while most of the IT experts claimed they were quite knowledgeable because they were thought in school. The individuals also responded quite well though many did not know about cloud computing, but made aware through further explanations by the researchers as shown in figure 4.2.

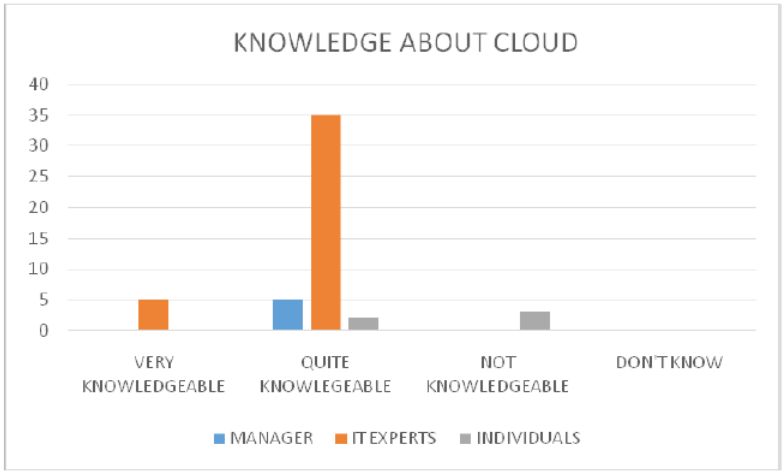

Figure 4.2

4.3.1 Adoption of Cloud Computing in Ghana

Among the various categories, most were strongly in favour of the adoption especially the IT experts, the managers quite agreed as well as the individuals that cloud computing should be adopted. In the figure below, their various representations are made. Only a few individuals were indecisive as shown in the figure 4.3 below:

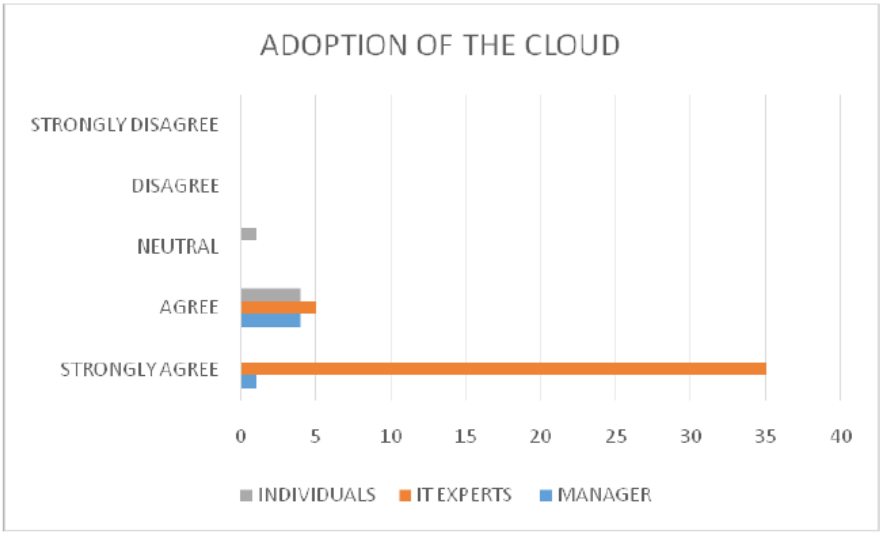

Figure 4.3 Adoption of Cloud Computing in Ghana

4.3.2 Willingness of Organisations/Individual to adopt cloud Computing Services

In all institutions visited, the survey provided that, all institutions were already using some forms of the cloud computing services. In effect, all five managers and IT experts were already in the cloud service. But with the individual survey, most of the claimed that they were using it while the others were thinking about using it. The figure 4.4 below shows the graphical representation

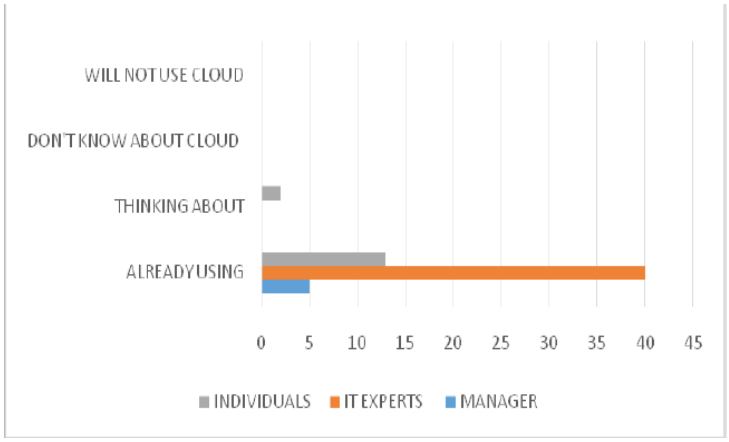

Figure 4.4: Companies Willingness to Adapt to Cloud Computing

4.3.3 Cloud Computing Delivery Model Used

As cloud computing is an emerging technology in developing countries, organisations and individuals use the services on software based- that is, Software-as-a-Service. These organisations and individuals explored the availability of the software especially those with mobile phones.

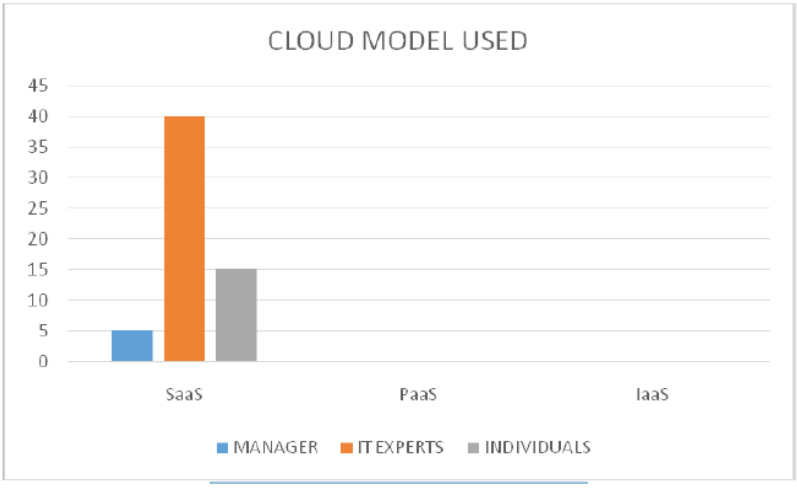

Figure 4.4: Cloud Computing Delivery Model Used

The illustration above shows that, currently, service providers only render software-as-a-service and end-users were making use of the already available software mostly installed on mobile phones in Ghana.

4.4 Benefits and Drawbacks of Adopting Cloud Computing

In this section, we looked at the impacts of cloud computing in Ghana.

4.4.1 Expected Benefits

The core benefits as portrayed by the survey shown that, majority of the managers wanted more flexibility in service and cost savings as compared to other benefits. The IT experts were marginally distributed across the listed benefits, while the individuals went in for flexibility and complexity reduction as shown in the table 4.2 below:

Table 4.2: Benefits Expected from Consumers

CATEGORY	MORE FLEXIBILITY	COST SAVINGS	BETTER SCALABILITY	COMPLEXITY REDUCTION	COLLABORATION	IMPROVED SECURITY
MANAGER	3	2	0	0	0	0
IT EXPERTS	5	7	7	8	0	13
INDIVIDUALS	13	0	0	2	0	0
TOTAL	**21**	**9**	**7**	**10**	**0**	**13**

4.4.2 Major Concerns

The network availability and how people were not too much convinced about whether the data were really secured were of much importance to the respondents. Issues of privacy were also very significant. The real fact is that, it may be protected from the private individual but the question remains that, "what about the service providers' access to the data or service". The illustration below shows the distribution of the main distresses regarding cloud computing in the views of the sampled people.

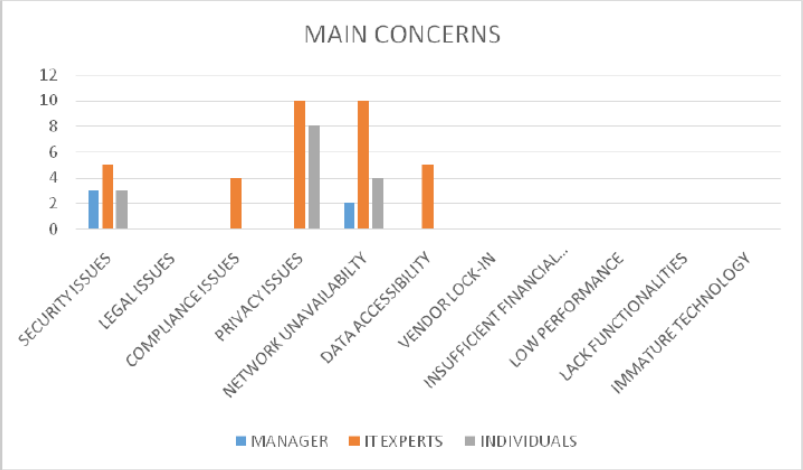

Figure 4.5: Respondents' Major Concerns of Cloud Computing

4.4.3 Main Security Concerns

In terms of data processing, everybody does not seem to come into good terms with data security concerns. It is obvious from figure 4.6 that most of the sampled population agreed that, there are security issues about usage of the cloud computing.

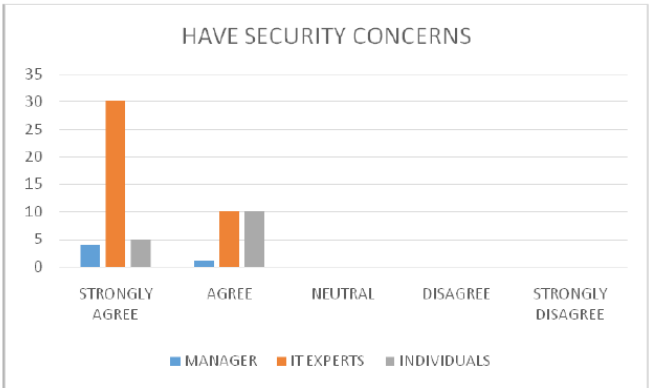

Figure 4.6: Respondents' views on whether they have security concerns of Cloud Computing

4.4.4 Factors Influencing Enterprises Decision not to Adopt Cloud Computing

Several factors affect the decision of enterprises not to adopt cloud computing. From figure 4.7 below, all categories have interest in a particular trend of problems. Each category has a say in what another category has talked about. This intersection means that, the identified problems are of critical concern to them than other issues.

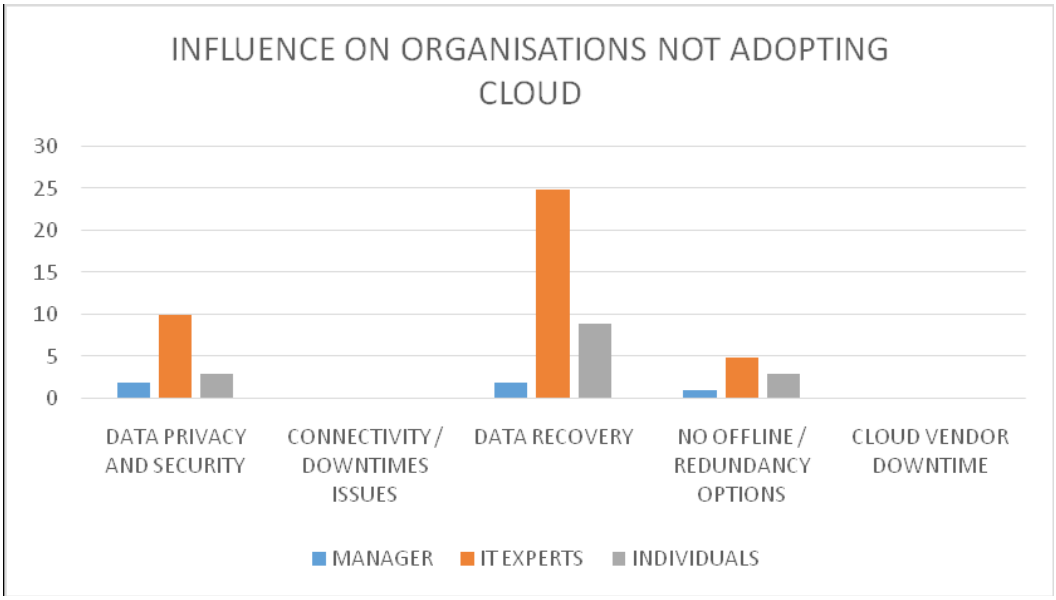

Figure 4.7: **Factors Influencing Enterprises Decision not to Adopt Cloud Computing**

5. SUMMARY, CONCLUSIONS AND RECOMMENDATION

After a comprehensive study and an insightful analysis into the gathered data, the findings of this study offer awareness to enterprises and consumers in Ghana in migrating to the cloud. To achieve this, it is vital for governments and private organizations as well as individuals to consider the essential benefits and the drawbacks associated with this research. These very factors can be utilized to shape the adaption.

5.1 Findings

5.1.1 Knowledge of Cloud Computing in Ghana

This study showed that, several players had knowledge of cloud computing. It was evident that, IT experts were very knowledgeable in the concept of cloud computing. They exhibited extensive knowledge on the basics of cloud computing which underlines the crucial benefits and drawbacks, cloud delivery and deployment. This knowledge of cloud computing are mainly learnt as they were taught in schools or personally learnt through books and the internet. Some managers and individuals were also conscious of the concept and the associated benefits. To some, they were using the service but had not come into contact with the term before. They only had knowledge of the individual services and were caught into it by the advertisements of the service providers. Further explanation brought their awareness to the concept.

5.1.2 Cloud Computing in Ghana.

It is evident in this study that, Ghana as a developing country is also engaged with cloud computing services but at an infant stage. Both government and private enterprises as well as individuals use cloud services in one way or the other. From the data gathered, it came out that, the government of Ghana - through the Bank of Ghana - offers cloud computing services through Ghana Inter-Payment & Settlement System (GhIPSS), which is the central hub for e-zwich and gh-link operations across the country. They offer POS services to government agencies like the Ghana National Service Scheme, and links inter-payment systems between banks in the country. Since this is offered by the government, it allows other financial institutions to access data therefore making it a public cloud. Other private institutions provide cloud services to both private and public institutions.

With GCB Bank Ltd., they were powered by STL Ghana Ltd., which provided a wide range of SaaS services including internet services, internet banking, Email and SMS alerts. In Ghana, it is acclaimed that STL Ghana Ltd is biggest provider of cloud services. Odotobri Rural Bank Ltd, Amansie West Rural Bank and St. Martin De Pores Co-operative Credit Union engaged the services like mobile banking applications and SMS alerts provided by EBITS Ghana Ltd., and TextGenesys Ghana Ltd. These services are delivered in private clouds. These services were rendered through mainly phones and relatively through POS machine. Most individuals also relied heavily on SaaS services provided by Microsoft, Google, Yahoo, Facebook, and Twitter mainly through phones or tablets. They engage much in private cloud activities than other delivery model. Despite the conforming trend of interest in cloud computing in the country, there were some preventive factors to the adoption. These include speed and unreliability of internet, lack of standards, legal issues and data security. Those that are using the services are making good use of it but mostly for private use.

5.1.3 Cloud Readiness in Ghana

As Vodafone Ghana gives the country access to SAT3, and a setting up of national fiber optic backbone, with four submarine fiber optic landing stations (Vodafone Ghana, Mainone, Glo

Ghana and MTN Ghana), the Ghana Government has an upper hand in making the dream of cloud computing very practical.

Inadequate ICT tools is a major challenge in Ghana. In October 2015, Ghana Education

Service in collaboration with Rogam Links Ghana (RLG), trained several teachers in basic computing across the countries but the ICT tools during the training activities were a major set backs. The government needs to provide computing infrastructure to promote the adoption of the cloud.

5.2 Conclusion

Cloud computing offers a wide range of advantages though it has some draw backs associated with it. These benefits can be reaped of in the form of scalability and more flexibility. The major aim for undertaking this study was to gain comprehensive knowledge about the nature of cloud computing and its consequences, thus, exploring its effectiveness. In Ghana, individual's usage of the cloud is very significant. They cannot be taken for granted because they are the ones most enjoying its varied services. Most of the service providers render the services direct from developed countries and the local ones operate with international affiliation. There are great avenues to motivate firms of small economies to engage on the provision side of the cloud market. These take account of provision of data centers and management, both autonomously and in at par with global cloud providers, cloud collectiveness and service integration, and the development and provision of cloud services to diverse parties, not forgetting local enterprises and persons. It should be emphatically stated that, cloud computing is gradually growing but when harnessed with education, it will cover the whole area in scope.

5.3 Recommendations

The findings of the study and conclusion drawn serve as points for a number of recommendations for considerations by enterprises and individuals.

Education: It is ignorant for an individual to make use of cloud service without any knowledge of it. Government and enterprises should intensify their sensitization programmes to educate their employees on particular services they use. Organisations should not only be interested in selling and making money. They should educate their consumers to have a fair knowledge in the services they provide. This will broaden the recognition of the impression people have about cloud computing in small economies.

Capital and Technical Expertise: For organisations that want to fully render the services of cloud computing, they need to be financially equipped but in developing countries, insufficient capital and deficient know-how has prevented local firms to fully provide cloud services. They are just limited to "petty" and "one-way" service. Other times, they need partnership from foreign origin. In effect, they need financial and personnel empowerment to cushion their efforts to provide full cloud computing services.

Legal Issues: Despite the fact that there are no specific rulings to regulate the migration into the cloud, it is very apparent for the following areas to require specific law reforms: Data privacy, Protection of data, Data security and measures to control cybercrime. Now that, cloud computing is in its infant stage, governments are advised to use this opportunity to enact laws that will secure the interest of both the provider and the consumer. There is no argument that we are dealing with sensitive information here, so it must be protected as such. A national cloud strategy should be adopted which is coherent and should serve as a national roadmap for operation of cloud computing.

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