Online Storage: Are Small Businesses Facing a Dilemma in Developing Economies?

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Abstract— **Several studies have shown that the adoption of cloud computing allows small and medium-sized enterprises (SMEs)to achieve business competency, improves performance, and allows them to maintain their competitive advantage. Using qualitative data collection approach, empirical data was collected from 11 SMEs who have either adopted, intend to adopt, or have no immediate plans of adopting cloud computing services as a business strategy. This paper primarily explores the contributory causes of the slow adoption rate of cloud computing services by SMEs in Ghana. The findings reveal that even though other factors come to play in their decision to adopt cloud services, SMEs are more concerned with security and privacy, loss of control, power outages, unreliable internet connectivity, the lack of technical skills and knowledge, and the legal and regulatory uncertainties associated with cloud computing. It is envisaged that knowledge of these concerns and appropriate recommendations will help increase the adoption rate of cloud computing by SMEs.**

Keywords- Adoption; cloud computing; small and medium-SMEs; business strategy.

I. INTRODUCTION

Small and medium-sized enterprises (SMEs) are key to the socio-economic development of many countries around the world. In Ghana, SMEs account for about 90% of registered firms, 70% of gross domestic product (GDP) and about 80% to employment [2]. SMEs in Ghana are characterized by their ability to help in the mobilization of funds which would have been idle, serve as a seed-bed for local entrepreneurship, are labour intensive, and promote indigenous technological know-how. Additionally, they promote the equitable distribution of income as a result of their labour- intensive nature and the diversity of their operations. SMEs help stabilise the domestic markets and help maximize the scarce resources available and thus ensure a long term economic growth. According to [25]

SMEs as a whole, contribute to the growth of the Ghanaian economy through productivity and innovation.

But despite their contribution to the economy, there is the problem of SME sustainability, especially in the global market. There is therefore the need for SMEs to design and implement new strategies, and information technology (IT) is at its topmost [18]. According to [1] the use information and communications technology (ICTs) has become a catalyst for business processes, becoming a support tool for managing businesses, leveraging at developing strategies for achieving competitiveness and innovation in business operation, and bringing sustainability to SMEs over a period of time. The use of ICT solutions, in particular cloud computing, has the potential to improve SME competitiveness and thus contribute towards sustainability [31].

In Ghana however, cloud computing is seen as a paradigm shift from the traditional form of computing and therefore the study has the objective of investigate the challenges associated with the adoption and usage of this new technology by SMEs. It attempts to find out how these challenges affect their decision use the technology as a business strategy.

II. THEORETCIAL ISSUES

A. Small and Medium-sized Enterprises (SMEs)

SMEs are privately owned entities and often operated through partnerships or sole proprietorships. There is no universally accepted definition of small and medium-sized enterprises. Due to their global diversity and characteristics, the definition depends on the context in which they find themselves. Each definition therefore uses certain criteria such as number of employees, annual turnover or balance sheet. The [15] defines SMEs as businesses which employ not more 250 persons and/or have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet not more than EUR 43 million.

Thus, the definition varies depending on one's context. In Ghana, the most commonly used definition of SMEs is based on the number of employees of businesses. The Ghana Statistical Service (GSS) defines small business as those that employ less than 10 persons and others that employ more than

10 people are termed medium and large-sized enterprises. On the other hand, the National Board for Small Scale Industries (NBSSI) in Ghana uses fixed assert and number of employees as their criteria in the definition of SMEs. According to [29] NBSSI considers businesses that employ not more than 29 people, has plant and machinery (excluding land, buildings and vehicles) not exceeding US$100,000 as small enterprise, while those employing not more than 99 people and fixed assert not exceeding US$1,000,000 are considered medium-sized enterprise.

B. Cloud Computing

With all the much talk about, there is no consensus when it comes to the definition of cloud computing. According to [27] there is not one universally accepted definition of cloud computing. Different authors, organisations, and technologist have tried to define cloud computing from the business and technical perspectives.

However, some common ideas that run through most definitions are data storage, Internet-based, service, on-demand procurement, and computing resources. The National Institute of Standards and Technology (NIST) put forward a formal definition of cloud computing that provides an in-depth understanding on the subject of cloud computing from the technical perspective. According to [36], "Cloud computing is a model for enabling 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". NIST also put forward five essential characteristics, three service models and four deployment models.

C. Characteristics of Cloud Computing

Cloud computing is uniquely characterized, making it different from the traditional form of computing. From the NIST definition, five characteristics of cloud computing were identified: Broad network access, on-demand self-service, resource pooling, measured service, rapid elasticity. Broad network access is where computing resources in the cloud are made available on multiple devices through the Internet. On-demand self-service is the ability to obtain computing resources in the cloud at any given time and being able to self-provision depending on one's needs at a point in time. Resource pooling allows the service provider to combine computing resources to multiple users. The measured service characteristic means the amount of pooled computing resources used are monitored and reported back to the user and thereby establishing the rates of consumption and its associated cost. Finally, rapid elasticity of cloud computing means user has the ability to automatically increase or decrease computing resources depending on their requirements and for only the period of a specific task or period.

D. Cloud Computing Deployment Models

Cloud computing can be classified as either public, private, community, or hybrid in terms of its deployment. In public cloud, computing resources are made available to the general public over the Internet [5]. Examples of public cloud are Google Apps, Salesforces, Amazon Web Services, etc. In private clouds, the infrastructure is designed, built and managed by the organization intending to use that service [46]. Community cloud is formed by governmental organizations, educational institutions, healthcare industry and similar industries that operate under shared goal and rely very much on shared data [12]. Hybrid cloud is the combination of two or more of the previous deployment models (private, community, or public) which are bundled together but each operating as a unique entity and separately [28].

E. Cloud Computing Service Models

Cloud computing service models describe the various types of services that can be obtained from the cloud and this is dependent on the level of abstraction and the resources they provide. According to [8], three main categories of cloud computing services can be identified: Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS). Platform as a Service delivery model of cloud computing focuses on the rental of infrastructure so the user gets a platform to build their own applications with programming tools provided by the provider [4]. Examples of PaaS include Google App Engine, VMware's Springsource. In IaaS, the service provider supplies the required hardware resources (CPU capacity, memory volume, servers, data storage, management control, and communications programmes) needed to run a customer's applications. The user signs up for the hardware resources necessary and pays for the consumed resource over a certain period of time [34].

Examples of IaaS include Amazon Elastic Compute Cloud (EC2), Simple Storage Service (S3) and Simple DB. Finally, in SaaS, the application is rented out to the user and services accessed through the internet [41]. Examples of SaaS are Dropbox, Twitter, Microsoft Office 365, Web emails, Customer Relationship Management (CRM) application, and Google Apps. Most of these personal applications are however free online services [35].

F. Technology Adoption by SMEs in Ghana

According to [30] IT has the potential to improve operational efficiency and effectiveness, change the way businesses compete to redraw competitive boundaries. Modern business processes require ICT for planning, design, supply chain management, production and distribution. The use of ICT is therefore strategic in determining the competitiveness of SMEs. The Ghana ICT for accelerated development (ICT4AD) policy was introduced by the government of Ghana to facilitate and provide an enabling platform to ensure the development of the ICT industry to facilitate technology usage [7]. This policy

is meant to position the economy as an approach to bridging the digital divide between Ghana and her trading partners in the developed economies. This is an indication of the country's commitment to the use of ICT as a key developmental enabler. Despite the massive investments in ICT infrastructure to help improve ICT delivery and capacity building, Ghana still falls behind other countries regarding its usage because of challenges like the lack of strategy to harness the full potential of ICT for socio-economic development of the country, the lack of technical expertise to undertake ICT related projects, less developed regulatory and legal frameworks for the ICT industry, effective leadership and the political will for successful ICT projects and the high cost of internet usage [19]

Even though SMEs adopt ICT for commercial and production-related purposes, they are not able to harness the full potential of the technology they use. According to [44] this is as a result of poor ICT skills, high cost and the risk associated with investing in ICT. Additionally, the Ministry of Trade and Industry (MOTI) of Ghana stated that the use of outdated technology, low capital and human resource base [33], and the frequent power outages negatively affect SMEs in their adoption of ICT [3].

III. RESEARCH APPROACH

The study employed the qualitative research approach. The quota sampling approach was used to select SMEs. This method was used because of the heterogeneity of SMEs in the metropolis. It allowed a fair representation of the sectorial diversity of SMEs in the Accra-Tema metropolis of Ghana and as a requirement for reflecting their technology needs and practices. As a result, data was collected from these participants using face-to-face interviews. The choice of tool was to enable the researcher to deepen the understanding and explanation of the identified problem.

A. Sampling of Participants

In order to avoid the pro-adoption bias [39], SMEs for the interview were segmented into adopters and non-adopters of cloud computing. Using Roger's classification and based on responses, the eleven cases were categorized into three main groups according to the extent to which an SME is relatively earlier to adopt cloud computing than others. The first group were cloud service users and labelled as "adopter" (G1-G4). Four SMEs who participated in the study had already adopted cloud computing services. The second group was labelled as "prospector" (G5-G9) and these are firms that have not yet adopted cloud computing services, but intend to adopt at least one of these cloud services in the next three years. Five firms who participated were prospector firms. Finally, the last group included firms (G10-G11) who have "not adopted" cloud computing services and do not have any immediate intention of using it. Two firms in this group participated in the study. Participants were selected from similar organisational positions considering their technical and managerial expertise

to evaluate the firm's existing IT system as well as cloud computing services.

B. Data Collection Methods

This study employed more than one instrument for collection of data. Using multiple data collection instruments increases the credibility of the data [45]. The researcher therefore used multiple data collection methods – interviews and literature findings. The study employed open-ended semi-structured interviews as primary sources of data, and literature review of published studies as secondary sources of data. The development of the open-ended interview guide took into consideration [37] qualitative interviewing strategies. Participants were asked the same questions from the interview guide but the exact wordings and sequence of the questions were directed by the course of the interviews.

IV. RESEARCH APPROACH

The outcome of the interview of SMEs in the Accra-Tema metropolis of Ghana on cloud computing adoption issues forms the contribution of this paper.

A. Current State of Cloud Computing Adoption

Respondents were asked to indicate their current adoption stage. It is depicted from Figure 1 that respondents were at various levels of cloud computing adoption decision.

Which of the following statements best describes your company's current situation?
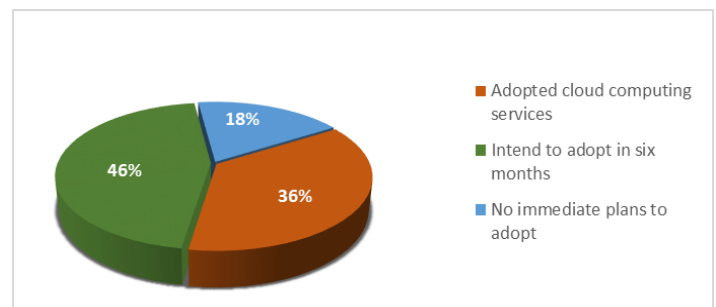

Figure 1. Adoption Decision Stage

Only 18% of respondents do not have any immediate plans of adopting cloud computing service in their operation. However, 46% have already adopted and 36% are thinking of adopting in less than a year's time and this is encouraging.

Cloud computing is an Internet based technology, and as such it was essential to determine the initial Internet experience of respondents. This provides an idea of the knowledge and usage of the Internet. Respondents were therefore asked two questions regarding Internet usage and Internet security breaches.

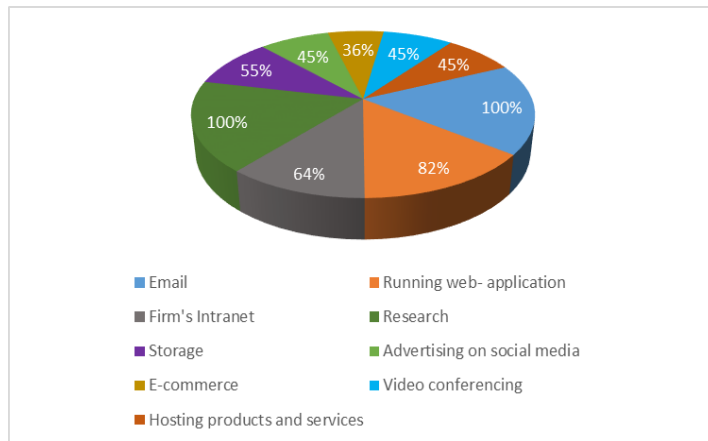In what ways has Internet been adopted in your firm?

Figure 2. Ways Internet is used

All (100%) respondents indicated that they use the Internet for their e-mail services and for research; 82% and 64% of respondents run their web-applications and firm's intranet respectively with the help of the Internet; 55% of respondents use the Internet for storing data; 36% indicated the use of the Internet for e-commerce purposes; while 45% of respondents use the Internet for advertising on social media, video conferencing, and hosting their products and service.

Further to ascertaining the perception that the Internet is virtually an ungoverned space, respondents were asked whether or not they have experienced any Internet security breaches that affected their operation. These findings are shown in Figure 3.

Has your organization ever experienced an Internet security breach that affected business operations?
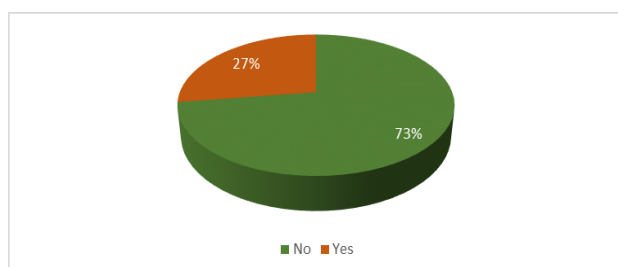

Figure 3. Internet security breaches

Figure 3 indicates that majority (73%) of respondents have not experienced any form of Internet security breach.

Respondents were asked series of questions derived from literature review that borders around adoption concerns. They were asked to indicate whether some pre-determined cloud computing adoption concerns applied to them and the responses are presented in figure 4 below.

What are the key cloud computing adoption concerns?
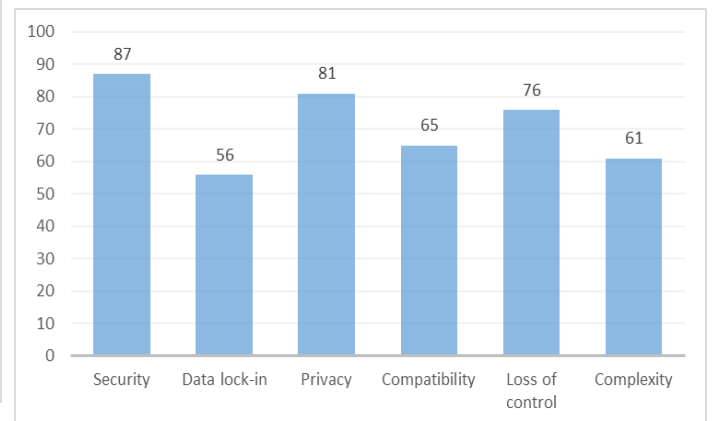

Figure 4. Key Adoption Concerns

Participants were asked to state and explain some of the adoption concerns that affect the decision the decision to adopt and use cloud computing. Some of the responses to this question are as follows:

A. *Loss of Control*

Although the concerns of loss of control are largely hypothetical and psychological rather than actual, due to the immaturity of cloud services, standards on the delivery of services and the constant evolving nature of the different models, users may have genuine concerns about the provider's viability and operational processes [38]. Adopters (G1-G4) expressed their concerns of losing control over their data whilst in the cloud. They attributed this to the fact that data is hosted on a third party's infrastructure and they have no control over this infrastructure. G1 stated: *"There is always that concern that risk when you are using a third party; anything can happen to your data because you do not have control over how they store it".* According to [32], in a cloud's shared pool of resources, business owners have limited control over their system's management. For prospectors (G5-G9) and non-adopters (G10-G11), they expect to have total control of their information at all times and as G9 puts it: *"Once you have given your data to a third party, you want to be sure it is under your control", and "so it will be a business concern"* (G11). They hope to run backups of their data internally to have some sort of control. This perceived loss of control of data can have a negative influence on the decision to adopt cloud computing.

B. *Privacy and Security*

Moving from in-house IT infrastructure to cloud services is often associated with data security and privacy breaches. They are among the typical concerns businesses may have using cloud computing. In this study, all respondents

(adopters, prospectors and non-adopters) agreed that the issue of security and privacy are their biggest concern to adoption. According to [32], enterprises are likely to adopt cloud computing if they perceive cloud computing as a secure solution. The majority of participants (G1, G4, G6, G7, G8, G11) expressed that the evolving nature of cloud computing and the fact that data is communicated over public internet may increase data vulnerability. This can result in unauthorised data modification and data deletion. According to [16], there is the challenge of application security of data inherent in cloud computing. For G3, the evolving nature means that there are no fixed privacy regulations as these vary from country to country and specifically stated: *"Our provider is outside the country and we do not know the cross-border data regulations"*. Another factor that came to light is the security of information (G2, G5, and G11).

According to [10] the general anxiety of malicious attacks aimed at cloud providers also increases the fear of loss of control. For participants, their information is the core of the business and they fear for the security of sensitive data to security risks in the cloud. G2 stated: *"........in this industry where several people can access by virtue of its exposure to internet, which is essentially an ungoverned space, so that is a concern"*. SMEs as a result feel the need to backup their information internally (G2, G5, G9, G11). Other participants (G1, G3, G4) underline some of these privacy regulations in their SLAs so that the service provider bears some responsibilities.

C. Unreliable Internet Connectivity

Cloud computing is an internet-based technology and as such there needs to be a reliable internet connection to operate cloud-based services. The availability of internet is therefore major factor that impacts on the effective adoption of any internet technology [42]. In the study respondents (G1-G11) consistently mentioned internet connectivity as a major factor that negatively affects the adoption of cloud computing. For adopters (G1-G4), their adoption of cloud computing has been plagued by unreliable internet connection from internet service providers (ISPs). This has led to a situation where they keep changing ISPs with the hope of getting a better internet connection. There are often unstable and slow bandwidths in developing economies like Ghana [44], thereby affecting the attempts at accessing cloud-based services. For prospectors and non-adopters (G5-G11) there is a fear of not being able to access cloud-based services when needed because of poor internet connections. G7 commented: *"Cloud is an internet based service, so you will require having internet access at all cost if you want to access the cloud"*. A non-adopter agrees: *"Without a stable internet connection, you cannot use cloud"* (G11). Poor broadband connectivity is therefore a barrier to enterprises in their attempt to access software and other applications remotely [43] G5 and G6 hope to increase their bandwidth prior to the deployment of cloud-based services for easy access to resources in the cloud.

D. Power Outages

Though cloud computing is an affordable option for businesses to reduce costs involving electricity [40], the online nature of the service makes it dependent on a constant power supply and a reliable internet connection. Adopters see the frequent power outages experienced in the country not as a barrier to the adoption of cloud computing services. Some are able to afford generators to ensure a constant supply of power. As a result, G1 for instance, answered: *"It doesn't restrict us from using it. Sometimes it just makes it difficult for us to use it"*. However, for prospectors, this is a big barrier. They consistently mentioned the unreliable power supply as one factor that negatively influences their adoption decisions. To them even though generators can be used to keep the power on, not all can afford to run for long solely on generators. This means they will not be able enjoy the constant availability of the cloud services. Non-adopters complained of the unstable power supply as a major barrier to the adoption of cloud services in the country. One non-adopter (G10) compared the severity of this barrier in a comment: *"Power outages are even worse than internet connectivity"*. SMEs therefore need a constant availability of power get the satisfaction of using cloud services.

E. Lack of Knowledge and Technical Skills

An idea of SME's knowledge of cloud computing will help in the decision to adopt the service and eventually to other changes that may involve some risk. Adopters (G1-G4) and prospectors (G5, G7) expressed the fact that because most of their business operations are in the cloud, they would hire personnel based on their technical knowledge of cloud computing services. Adopters acknowledged that though they have enough knowledge and technical expertise to internally manage and administer cloud services, they occasionally seek technical support from service providers. Prospectors (G6, G8, and G9) mentioned that they lack the technical skills needed to run a cloud system and for G9, they intend recruiting people with the right cloud know-how before adopting the service. For G6 and G8, they hope to recruit personnel with specific cloud skills to help them handle specific risks and train existing staff in cloud computing. *"We don't have certified IT security person. Especially when it comes to cloud, security is a big issue. We should be able to get someone who can solidify our IT security network"* (G6). Non-adopter (G10) admitted a deficiency in cloud knowledge and stated: *"I don't think most of the personnel know about cloud computing. We lack the knowledge and will therefore need training"*. For non-adopter (G11), though there is a lack of knowledge of cloud computing, *"everybody working here has some basic knowledge when it comes to computing"*. This is a positive sign for any future intention to adopt cloud services.

F. Legal and Regulatory Uncertainty

According to [20], innovations in their early days usually have the potential to produce some degree of uncertainty. In the

current study, much of the uncertainty was centered on the movement of data between servers and where the server is located at a particular point in time. This clearly reflected in the answer by G8*: Most of the service providers are outside the country and the movement of data across borders may bring about some legal issues".* Adopters and prospectors tend to underline this point in their agreement with service providers to reduce the degree of uncertainty by making available their data protection laws. As a result, G2 commented: *"If there are any regulatory implications of moving data from one point to another, what we would have done is we would have satisfied those regulations from our perspective",* and *"....so we would have requested for evidence of compliance from the service provider"* (G2). Respondent G2 further added*: "So we tell them of all these requirements and if they will be able, we sign a Service Level Agreement which we work out penalties".* Adopter participants (G1-G4) view cloud computing as a paradigm shift from how they work and are therefore skeptical about the future of the technology. Some are as a result cautious about putting their sensitive information in the cloud as G2 commented: *"So for those kinds of systems that may pose very sensitive business information, they are hosted in-house, they are not put outside. So there is some uncertainty about moving business support systems into the cloud and transferring it from another country".* Participants G5, G7, G10 and G11 feel the open nature of the Internet makes their information vulnerable to attackers.

The outcome of the interview gives further credence to the fact that, cloud computing adoption is surrounded by several concerns and barriers and these need to be considered to ensure a successful adoption

V. CONCLUSION

Although the findings present a different perspective from what is documented in literature, some of the issues that came up from this study gives further credence to the fact that cloud computing adoption by SMEs is surrounded by several concerns.

SMEs feel the hosting of resources on a third party infrastructure means that they will lose control over those resources to the service provider. Additionally, there could be intentional sabotage through data destruction or disrupted service by other parties or even the service providers and the interception of information by intruders during transmission over the internet.

Cloud computing is still a new technology and full of uncertainties for SMEs especially when it comes to the legalities of moving data from one country to another. For some SMEs, the evolving nature of cloud computing means the absence of fixed data privacy regulations but this varies between countries. Often users are not aware of the exact location of their data and this could potentially lead to trans-boundary legal issues as the laws of data protection in one country may differ from that of another country. SMEs claim this has affected the rate of adoption and a contributory factor to their late adoption.

The lack of knowledge about cloud computing was also cited as a barrier to adoption. Most SMEs lack the knowledge and expertise to manage a cloud system. There is the need for the recruitment of personnel with specific cloud skills to help them handle specific risks and train existing staff in cloud computing. Similarly, because they lack the knowledge about cloud computing, they are not able to predict the outcome and this leads to some degree of uncertainty. They are therefore skeptical when it comes to leaving their information in the cloud.

Cloud computing is an internet-based technology and therefore requires the presence of a reliable internet connection. However, in Ghana this is not the case. Most SMEs surveyed have had to change ISPs to establish a reliable and uninterrupted internet connection. Further, due to its online nature, cloud computing requires a constant power supply. The frequent power outages experienced in Ghana are another factor that negatively influenced the adoption decisions. They feel that although generators can be installed to keep the power running, not all SMEs can afford to run solely on generators. This is a major adoption concern. It can therefore be concluded from the findings of the study that, cloud computing is a new technology that has its adoption surrounded with uncertainties, issues and concerns.

VI. RECOMMENDATIONS

It is recommended that service providers and SMEs alike understand their own accountability for concerns that were mentioned and their responsibility for implementing the necessary measures.

It is expected that service providers will continually reassure SMEs of uninterrupted access to their data. When SMEs have uninterrupted access to their data, they perceive having control of the data. If SMEs perceive they are in control, they are more likely to trust in cloud computing services and hence adopt the service.

It is also expected that service providers will implement effective, efficient and operationally functional data protection and prevention techniques. The continued existence of security measures by the service provider improves SMEs' perceptions of the service provider's ability to store their data in a secured manner.

The sharing nature of cloud computing and open nature of internet makes data in transit susceptible to uncontrolled access. There must be guarantees from the service provider that data in their care will not be used for any unintended purposes, as issues of privacy in the cloud mostly borders around the breach of trust. Also, privacy laws and regulations can be implemented to protect data.

The technical infrastructure regarding broadband connectivity negatively impacts adoption of cloud services. It

is therefore expected that there will be the development of efficient communication infrastructure for competitive production and distribution to ensure reliable and sufficient bandwidth. Additionally, the infrastructure for the generation of a reliable power generation is lacking, affecting the adoption of cloud computing. There is therefore the need for basic infrastructure for generating power to ensure reliability and constant availability of cloud services.

Cloud services impact a range of regulatory aspects both within and across jurisdiction. It is expected that regulators will establish information regulatory procedures and coordinate regulatory decision-making that is targeted at SMEs and cloud service providers. Finally, there is the issue of acquiring appropriate skills and technical knowledge in the deployment of cloud service. It is expected that SMEs will develop the necessary skills and knowledge to help deliver the benefits it expects from cloud computing.

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