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Cloud Computing Security: Acceptance of New Technologies by Small and Medium-Sized Enterprises (SMEs)

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ABSTRACT:
This this paper discovers the challenges that SMEs face in relation to Accepting new technologies, particularly in adopting cloud computing technologies. Technology change in businesses thought to be challenging process (Venkatesh et al. 2003). For many businesses in order to stay in competitive market, they will have to align their business to new technologies. Businesses face number of challenges in adoption of a new technology these include, user acceptance, security, cost and reliability (Bauer and Adams, 2012). This paper discusses each of these concerns and outlines the factors that affect the decision to adopt cloud computing in SMEs. The purpose of this paper is to identify critical factors and develop a new framework that leads to a successful adoption of cloud computing by SMEs.

KEYWORDS: Cloud computing, Technology acceptance, Issues with cloud computing adoption, Cloud computing adoption and considerations, Small and medium-sized enterprises (SMEs)
Word Count: 3,064

INTRODUCTION:

This research project dissertation discovers the challenges that SMEs face in relation to Accepting new technologies, particularly in adopting cloud computing technologies. Technology change in businesses thought to be challenging process (Venkatesh et al. 2003). For many businesses in order to stay in competitive market, they will have to align their business to new technologies. Businesses face number of challenges in adoption of a new technology these include, user acceptance, security, cost and reliability (Bauer and Adams, 2012). This project discusses each of these concerns and outlines the factors that affect the decision to adopt cloud computing in SMEs. The purpose of this project is to identify critical factors and develop a new framework that leads to a successful adoption of cloud computing by SMEs.

CLOUD COMPUTING DEFINITION:

Multiple definitions exist for the term cloud computing (Marston et al. 2011) identified over 20 different definitions each addressing the concept from dissimilar perspectives ranging from an emphasis on the type of business model used, to explaining the underlying technologies employed, to drawing parallels with existing delivery systems. Overall, the name cloud is a figurative approach derived from the drawings used in telecommunication and computer networking disciplines to represent all hidden hardware and software infrastructure in a network (Van Der Molen, 2010). Accordingly, cloud computing can be thought as a metaphor referring to all the intricate and complex underlying hardware and software components encapsulated and hidden away from the view of consumers. Cloud computing is a model of providing ubiquitous and convenient on-demand network access to a common pool of configurable computing resources (eg, data networks , servers, data storage devices, applications and services - either together or separately) that can be provided quickly and released with minimal operating costs and / or appeals to the ISP. Self-service on-demand, the consumer determines and changes the computing needs, such as a server, speed of access and data processing, the amount of stored data without any interaction with a representative of the service provider (Van Der Molen, 2010)

SMALL AND MEDIUM ENTERPRISE POPULATIONS:

The selection of SMEs as the population of study is significant for several reasons. First, SMEs have been anticipated to be the earlier adopters of cloud computing propositions (Erl, 2009). Nonetheless, such predictions have not taken place as expected (Wu, 2011). Another significant reason for choosing SMEs and vendors as the population is associated with the limited amount of academic research literature

investigating the unique issues, problems, and management challenges that SMEs and vendors face in order to adopt novel IT solutions such as cloud computing.

SUMMARY OF SUPPORTING LITERATURE

REASONS FOR ADOPTING CLOUD COMPUTING TECHNOLOGY SERVICES:

Cloud computing has emerged as a new technological paradigm for on-demand delivery and consumption of shared information technology (IT) resources over the Internet. As a new innovation, cloud computing is considered one of the most significant advances in technology evolution of recent years, (Marston et al. 2011). This phenomenon is associated with the cloud's potential for dramatically altering and transforming how businesses provision, consume, and release computing power, make use of data storages and computer applications, and enable users to engage in access to various forms of networking infrastructures (Buyya et al. 2009). The multi-tenancy environment (where all customers share the same cloud platform), which includes sharing of software applications, networking infrastructures, and associated maintenances, makes it possible for developing the necessary economy of scales required to benefit both the service providers, who can now lease the same equipment to more clients, and the consumers, who can reduce the total cost of ownership (TOC) for expensive hardware and software (Takabi et al. 2010). Some of the most distinctive benefits include the ability that consumers have to access highly reliable and scalable systems developed with autonomic or self-healing capabilities (Wheeler et al. 2009). This transformational process should make it possible for organisations of all sizes, particularly small and medium enterprises, to derive a significant number of technical, financial, and strategic benefits from the adoption of cloud computer services (Armbrust et al. 2010). One of the benefits is the possibility of lowering total ownership costs associated with the procurement of expensive technology. Similarly, businesses could derive better resource utilisation as well as gain access to scalable computational power if and when the need arises for working with large volumes of data. At the same time, organisations would have with options for returning unused resources back to the cloud when they are not required anymore as well as avoiding paying premium prices for such transactions.

REASONS FOR AVOIDING CLOUD COMPUTING ADOPTION:

Despite much anticipated projections regarding SMEs leading role in adoption of cloud solutions, this event has not fully materialised. Recent surveys suggest that adoption of cloud computing by smaller firms is not taking place at the predicted rate or with the intensity that was earlier predicted (Benlian and Hess, 2011). Although cloud computing has the potential for increasing SMEs' organisational performance, the SMEs not seem to be realising such value. As suggested by Benlian et al. (2009), practitioner surveys place much emphasis in finding technical issues as the main causes of the problem, but fail to consider additional factors such as users' individual reactions and intention for accepting and adopting the technology. As Venkatesh et al. (2003, p.426) suggested, "For technologies to improve productivity, they must first be accepted and used by employees in organisations". (Sultan, 2010) finds number of concerns related to cloud computing including issues related to vendor control and vendor lock over user's private data. Similarly, Sultan suggested problems associated with performance and latency as critical concerns for cloud consumers. Additional research by (Kourik, 2011) pointed at the complexity of installing specialised cloud applications if consumers lack the necessary technical skills and technical resources in-house. Installation could be a challenge for many small organisations without the technical expertise or the human capital required to deploy mission-critical solutions. Of the drawbacks and limitation of cloud computing, (Katzan, 2010) pointed to privacy as a primarily key concern of many decision makers, arguing that consumers sharing resources, such as in multi-tenancy environments, may inadvertently gain access to resources from other consumers if the systems are not properly configured or if there are other unanticipated technical problems.

CLOUD COMPUTING ADOPTION SECURITY ISSUES:

Various authors on the future challenges of the cloud computing have identified issues and reasons why SMEs not adopting cloud computing. This also may act as barriers to the adoption of Cloud Computing by the SMEs and. The potential considerations are:

1. Security: this included data loss, phishing, cyber-attack, and new issues deriving from multi-tenancy (where all customers share the same cloud platform) like shared infrastructure (Armbrust et al. 2009). Companies have duty to protect data about customers and comply to data protection laws such as data protection 1998.
2. Data lock-in: the lack of interoperability between different clouds and the fact that each cloud provider has its own way of connecting with its customers, makes it very difficult for clients to change to another provider (Clemons and Chen 2011).
3. Data privacy, confidentiality and law requirements: customer cloud enterprises are obliged to comply with the current law with regard to privacy, access, protection and data location and, therefore, they must demand the Cloud provider complies with them (Tsaravas and Them is tocleous 2011).
4. Computer Weekly has identifies seven key steps in cloud computing security for SMEs. According to Toylar (2014) " Cloud security remains a key concern for SMEs and is still often cited as a chief impediment to moving to the cloud"1. Audit data this include review data to decide which data not to be shifted to the cloud due to restriction of the contract "confidential information" for instance company policy does not allow specific data to be transferred.2. Do homework this include shop for best cloud provider for example how data stored by provider such as is it with other customer data, does provider has any industry accreditations such as ISO 27001, how does it monitor and if any encryption can be used.3. Look at the contract, according to Taylor (2014) " Most SMEs will be presented with standard terms on a take it or leave it" businesses need to consider such solutions and look for appropriate services according to customers need for instance the provider will only act on customer's instructions, give assurances, specify the when the provider access the data.4. Encrypt data where necessary, to limit the risks SMEs need to place encryption on data the ICO advices businesses to consider whether encryption should be used.5. Check privacy policy this include amendment of privacy policy if is not allow to process data in the cloud.6.Manage contract, to maintain control of data throughout its lifecycle SMEs cloud providers security measures need to be monitored on regular terms to ensure meets the expected standard, SMEs need to receive updated security audit reports.7. Train staff, Talor (2014) stated " Security measures are only good as the people implementing them" staff should understand their responsibilities for example keep their authentication detail safe. (Toylar,2014).

In summary; Risks in cloud computing arise due to shared services, cross-border litigation, data location, inter-cloud compatibility issues, lack of legal support for consumers, trust issues on service providers, IT security risks, consumer issues, privacy issues, data segregation issues, and data proliferation issues.

Cloud computing advantages	Cloud computing disadvantages
Reliability	Migration issue
Scalability	Risk
Flexibility	Lack of control
Maintenance	Dependency
Cost saving	Constant evolve

Table 1: Cloud Computing Advantages and Disadvantages

Reasons for adopting cloud computing	Reasons for avoiding cloud computing
Remote access	Security
agility	Employee sills
Centralised data	Service level agreement SLA
Green computing	Managing business risks
Easy implementation	Latency

Table 2: Reasons for adopting and Avoiding Cloud Computing Services

For instance a survey carried out by computing website firm, in 120 IT managers in UK businesses, whether they adopt cloud computing technologies. Nearly half of SMEs said "No way". Below diagram shows this.

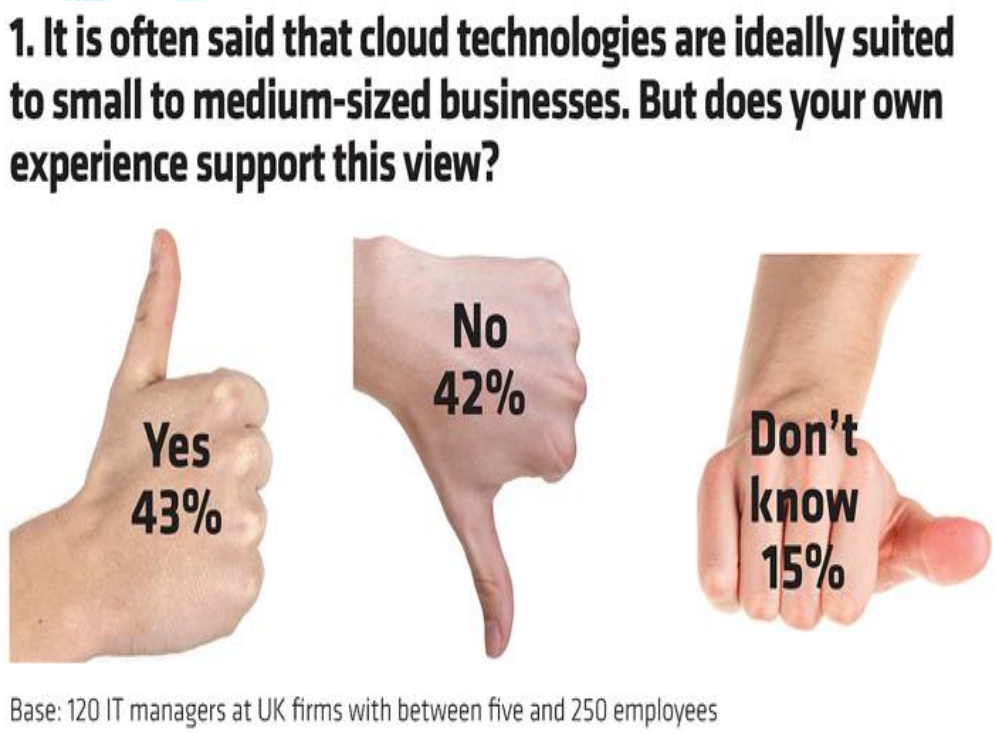


Figure 1: Cloud Computing? No way, say half of SMEs

(Leonard, 2014)

After conducting the literature review and exploring different academic views, it is most likely that SMEs have more concerns in comparison to confidence in adopting of cloud computing. SMEs fear number of risks may arise by adopting cloud services include reasons such data privacy, loss of data control, availability, quality of service, shared service concerns. However, the reasons for adopting cloud services are also great as there are many reasons such as cost reduction, scalability, access to better IT resources and core business focus. Taking both sites into consideration it's worthwhile to pay attention to cloud security issues as they are the reasons that not to adopt cloud technologies. Other considerations such as trust, transparency, complexity, employee skills and reputations are taken into account before the adoption of cloud services.

TECHNOLOGY CONSIDERATION MODELS:

Different theories and models developed in relation to considering new technologies by SMEs. In this literature section several models are compared;

TECHNOLOGY ACCEPTANCE MODEL:

The technology acceptance model (TAM) originally developed and proposed by Davis et al. (1989), is a theory that focuses on predicting specific behaviour of people in reference to the acceptance of new information systems. However, rather than providing a generic approach for predicting peoples' behaviour within the general scope of social environments, the TAM is centered around the acceptance and usage behaviour of computer users within the context of business settings (Legris et at. 2003). In its original version, the TAM consisted of five constructs including (1) perceived usefulness (PU), (2) perceived ease of use (PEOU), (3) attitude toward using (A), (4) behavioral intention (BI), and (5) actual system use (USE; Legris et al. 2003).

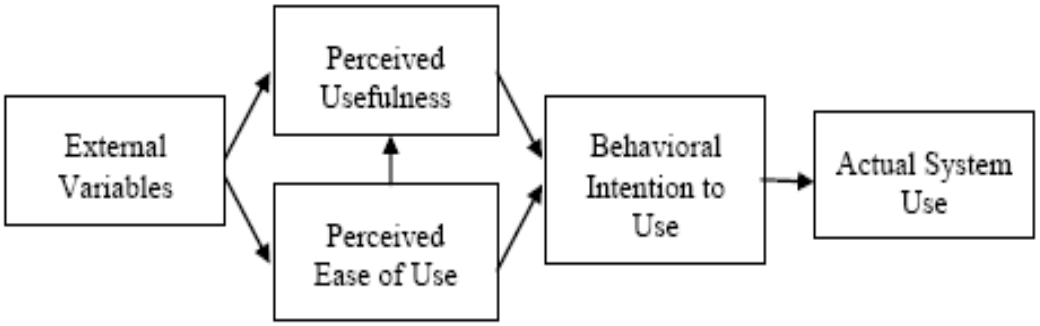


Figure 7. Technology acceptance model. Adapted from "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Studies," by V. Venkatesh and F. D. Davis, 2000, *Management Science, 46*(2), pp. 186-204. doi: 10.1287/mnsc.46.2.186.11926

Figure 2: Technology Acceptance Model

In the Davis et al. (1986) proposed that external factors have a direct influence on peoples' attitudes when faced with the use of a new computer system. External factors directly affect PU and PEOU, and in turn, influence and can be used as predictors of BI and eventually of actual system usage. Examples of external variables include prior experience that people may have with the systems, the presence of top management support in the use of the system, the presence of training and documentation, and the quality of the system. (Legris et al 2003). In reference to the predictors added to the TAM, PU refers to people's positive or negative perceptions that when using a given computer system could help them increase job performance. The predictor PEOU is associated with how people perceive how easily it will for them to use the system. Both constructs are used within the TAM as direct predictors of BI, that is, the intention of a user to perform a specific behaviour such as using the system.

MOTIVATIONAL MODEL:

The motivational model (MM) was proposed by Davis et al. (1986). to study acceptance of computer usage in businesses. The model is rooted in the motivational theory, which places emphasis on intrinsic and extrinsic motivation as the two main constructs leading a person to perform a particular activity (Davis et al. (1986). Davis et al. described intrinsic motivation as motivation that is driven by a person's interest or enjoyment for performing a given activity. An example of intrinsic motivation would be when a person is interested in learning and mastering the use of a computer program for personal gratification rather than just to comply with job requirements. For example, a person will master the use of a computer system thinking that this could result in increases in job performance, or in better compensation, or on gaining a new promotion. In the new motivational model, Davis et al. (1986) proposed two constructs, enjoyment and perceived usefulness, which are examples of intrinsic and extrinsic motivation respectively.

UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY :

These are themes which have long been considered underlying aspects of various user acceptance models (Venkatesh et al. 2003). Therefore, an additional research problem addressed by this investigation includes identifying predictor variables that better explain the potential acceptance of cloud computing solutions within the context of SMEs and vendors. The results of this investigation revealed that the UTAUT model for vendors was capable of explaining 70% of technology acceptance behaviour (Venkatesh et al. 2003). In contrast, previous models explained only 30% of acceptance on average (Venkatesh et al. 2003).

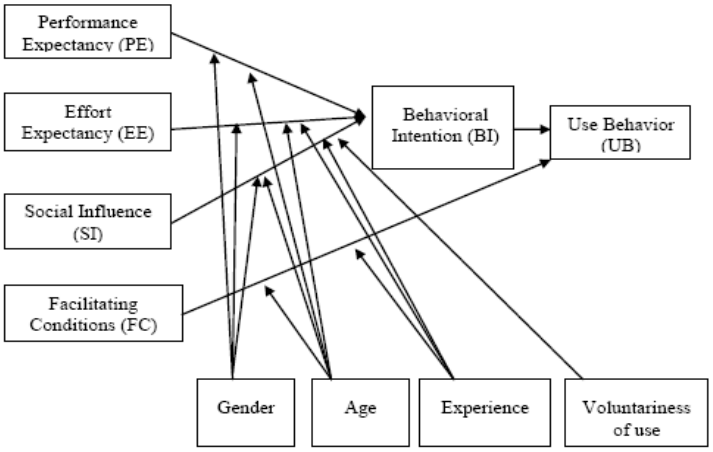


Figure 1. Unified theory of acceptance and usage of technology model (UTAUT). Reprinted with permission from "User Acceptance of Information Technology: Toward a Unified View," by V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, 2003, *MIS Quarterly, 27*(3), pp. 425-478. Copyright © 2003, Regents of the University of Minnesota. Used with permission.

Figure 3: User Acceptance of Information Technology

METHODOLOGY:

Secondary research methodology selected to collect data and help accomplish the goal of this paper. Because this project focused on analysing and discussing various secondary sources, therefore, such methodology is appropriate for processing data and answering the research questions. The sources include acknowledged text books, standards, analysts, reports, conference journals and websites. Based on the sources chosen it was best to select the research method to be qualitative methodology. The school of technology at Wolverhampton university library provided good resources such as hard copy books, online books and journals. Recent research work can be collected by using this methodology to widen the knowledge of the adoption of new technology considerations by SMEs, this helps to answer the research questions which are the main aims of this project. The main purpose of the paper is to answer the following two questions. What are the Fundamental Considerations for Technology Service Selection? Is Security a key Challenge in the Adoption of Cloud Computing by Small and Medium-sized Enterprises (SMEs? The secondary methodology chosen via internet search so that up-to-date research can be obtained.

DISCUSSION OF FINDINGS:

CONSIDERATION FOR TECHNOLOGY SERVICE SELECTION:

Every country which intends to have economic growth should consider technological growth as a factor also, in this sense innovation of new technology become of great attention. Use of Information Technology (IT) is a dynamic instrument which increases productivity of organisations internationally. The decision made by the Small and Medium Enterprises (SMEs) on whether or not to adopt cloud computing as a business technology is based on various aspects. Many research Hypotheses have being used to clearly elaborate more on the factors that should be considered. Basically, there appears to be four eminent theories about SMEs and the factors they consider to adopt cloud computing technology.

There is a rational approach of using human know-how whereby experience is the best teacher which is not the efficient way to optimise this technology (Scheinerman and Ullman, 2011). Therefore there has been analytical research which has been used to elaborate the correlation between two hypothetical frameworks. These includes: Diffusion of Innovation (DOI) and another one based on Technology, Organisation and Environment (TOE). From this research, some of the factors that affect organisational progress are individual features, internal assembly of the organisation and external features. This has given rise to a new model which relies much on the social scheme which is categorised in five major approaches which are discussed as characteristics of innovation, forms of innovation decision, communication networks, nature of communal system and change agent features. Through the research, it

is evident that the factors to be considered for the adoption of cloud computing falls under the three broad categories; Environmental, technological and organisational. One factor of great concern is scalability, where by one has to consider whether the provided technology can accommodate growth of the business without negative feedback from clients an example of such is; slow software which will upset the client who in turn will abandon your business. Rendering to the research conducted some of the features of Diffusion of Innovation (DOI) and Technology ,Organisation, Environment (TOE) have been adapted in creating the newest technology although TOE has been greatly accepted because it considers the aspect of environment which is not the case with Diffusion of innovation (DOI) standards. Bearing in mind that there are three feature of (TOE) Technological aspect, Organisation and Environment, each one of the aspect has to be reflected on individually (Willcocks et al. 2013).

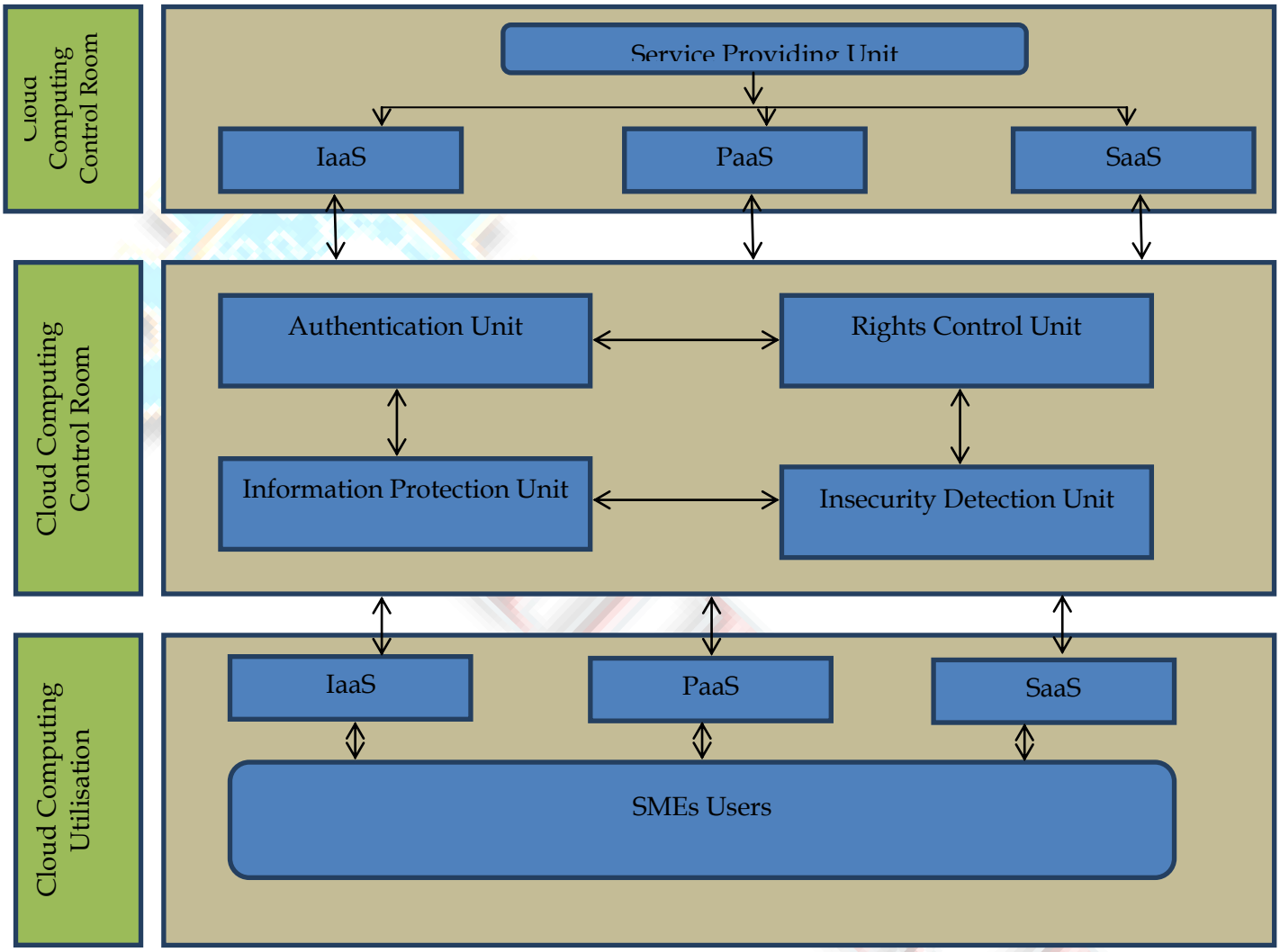
CONSIDERATION SUCCESS FACTORS:

Organisational factor cannot be successful without considering some inward factors such as topmost management upkeep, the size of the organisation and technical awareness. After the top management realises the implications of adopting cloud computing, this is approved after they consider the advantages of the recent innovations. It is therefore their function to ensure that change takes effect within the organisation by availing resources and making sure that the participants accept change. The top management also is at a position to offer favorable environment, long-lasting thoughts and suggestions on how to adopt cloud computing. Manager who are investigative and have great understanding of IT innovations are at a highly ranked I look at acceptance of new technology. Therefore, the more stable the top management the higher the chances of adopting new ideas to the organisation.The size of the firm is also of great concern, research shows that small size business enterprises faces more challenges than the large scale business organisation, these include challenges such as inadequate resources, lack of skills ,technological issues and thus it becomes hectic to adopt any new technology that comes up. Bigger organisations on the other hand are able to govern their resources, manage their technological know-how and investment which are always available to be employed incase need arises. Irrespective of the challenges faced by the SMEs, they still have advantages over the bigger organisation whereby they have fewer levels of administration and hence can compliantly make their decision which in turn bring revolution in the Small and Medium Enterprises (SMEs).The cost of implementing cloud computing is also convenient to SMEs because you pay for the services you use and hence it is not a burden to adopt the technology. In addition it has become easier for SMEs to look for market of their products based on the idea that they can advertise a new product at a reasonable cost and get commendable turnover.Another critical factor considered in any setup is technical inclination, an infrastructure is required where cloud computing can be implemented, business systems and network technologies provide a comfortable platform for establishment of cloud computing in any organisation. Therefore business organisations that are technically ready are at a higher chances of adopting cloud computing because they will have the essential resources for cloud computing. Cloud computing dealers enables clients to store their data online, access their servers and performs all the installation of software for their clients to ensure all their service are appropriately provided. Current business competition has given rise to developed infrastructure which enables instantaneous business environment. Cloud computing enables computerisation of resources within a business organisation, SMEs constantly adds values to their businesses through innovation and inventiveness.

CONCLUSION:

In the introduction of this project dissertation two research questions presented as an objectives of what would be the considerations in adopting new technologies by SMEs such as cloud computing technology services. It is believed that presented research accomplishes these objectives through variety of techniques such as literature review, analysis, explanations and evaluations.

According the discussed concept about cloud computing, consideration to its adoption and security issues revolving around the technology, it is therefore easy to understand both the benefits and drawbacks of cloud computing technology. The framework diagram below illustrates how the SMEs can adopt this technology ensuring that all factors are observed;



During this project research four key considerations regarding adoption of new technologies were discovered;

1. Security Considerations
2. User Behaviour Considerations
3. Motivation Considerations
4. Technology Acceptance Considerations

To ensure that Cloud Computing is the proper investment to make for SMEs it is important to understand the different areas of the diagram. The square diagram which is guarded by cloud computing control rooms and cloud computing utilisation is ensures that all considerations are observed. It is absolutely important to know that the cloud is secure and will remain secure.

This research can be developed further to identify each specific area that cloud computing cover in its current SLAs and standards and security considerations.

This study made an effort to understand the acceptance of cloud-base computing solutions within the context of SMEs and vendors. Based on the findings there are a number of recommendations for action in future studies trying to expand from the results. The first is replicating this study with the inclusion of variables such as age, gender, and experience. Results from the original UTAUT model for vendors suggested that all three factors play moderating roles in the relationships between PE, EE, and SI with respect to BI (Venkatesh et al. 2003). These moderating effects could offer additional detail to the predictability of each separate construct as applied to SME contexts.

A second suggestion for future study is the evaluation of behavioral intention on a post implementation phase in order to determine how well cloud solutions are accepted over time. For example, in larger settings Venkatesh et al. (2003) found that behavioral intention represented both an outcome as well as a

direct determinant of usage, and that along with facilitation conditions; behavioral intention had influence on the relative short term utilisation of technologies. In order to make this study possible it will be necessary to identify appropriate mechanisms for measuring actual usage as well as eventual diffusion. A third suggestion for future study is the combination of theories with behaviour related factors such as those evaluated in this study with additional theories that study technology acceptance based on factors such as security and privacy. Those two particular elements have been identified as major concerns for the effective transition to cloud-based solutions. (Biggam, 2011).

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