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A Framework for Cloud Computing Adoption in Small and Medium-sized Enterprises: A Case of the Accra-Tema Metropolis in Ghana

By

Martin Adane

A Framework for Cloud Computing Adoption in Small and Medium-sized Enterprises: A Case of the Accra-Tema Metropolis in Ghana

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Supervisor: Prof. Roxanne Piderit

Co-Supervisor: Prof. Marlien Herselman

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Abstract

Cloud computing adoption and usage is important to achieving business competition. This is done by making it a competitive tool for firms. The adoption of cloud computing enables firms to achieve greater business competency, improve performance, and allows them to maintain their competitive advantage. Since its emergence, there has been a surge in the adoption of cloud computing with research into its adoption primarily concentrated on bigger firms. However, a major characteristic of cloud computing is the anticipated possibilities it holds for small and medium-sized enterprises (SMEs). SMEs typically operate differently from larger firms and are not limited by resource constraints. For SMEs, the reduction in the financial burden normally associated with the adoption of new technologies is a significant benefit of cloud computing due to their financial constraints.

In Ghana, SMEs mostly use obsolete technologies and have a slow response towards new technologies. Thus, they are unable to harness the numerous opportunities technology presents to them to stay competitive. Cloud computing is still regarded as a new technology in the business world, therefore research that focuses on its adoption by SMEs to help them stay competitive is minimal. Available research on cloud computing in Ghana does not provide clear guidelines for ensuring a successful adoption process and the continued use of cloud computing services. This study seeks to investigate how a framework can assist SMEs in their use of cloud computing in the Accra-Tema metropolis of Ghana. A knowledge of the factors associated with adoption decisions and those that significantly influence the decision are required to ensure a successful adoption process.

The empirical data was gathered using a questionnaire and face-to-face interviews developed from literature and administered to users and potential users of cloud computing. The questionnaire and interviews primarily investigate key adoption factors and the findings are reported in this research study. The findings reveal interesting insights into understanding issues that affect the overall decision to adopt and use cloud computing services by SMEs. The findings show that the adoption of cloud computing can improve information management practices within SMEs. The findings also reveal that several factors need to be considered in the overall decision to adopt and use cloud computing to ensure a successful adoption process.

An initial cloud computing adoption model was proposed based on the empirical findings. Key adoption factors of the initial adoption model include adoption benefits and drivers, concerns and barriers, adoption interventions, and information management in the cloud. These factors served as an important foundation for the development of the proposed cloud computing adoption framework. The proposed adoption framework aims to assist SMEs to adopt and use cloud computing services and make them relevant in the global market.

Keywords: Adoption; Cloud Computing; Competitiveness; Competitive Advantage; Small and Medium-sized Enterprises.

Declaration

I Martin Adane, hereby declare that:

- The work in this dissertation is my own work.

1.

- All sources used or referred to have been documented and recognized.

2.

- This dissertation has not previously been submitted in full or partial fulfillment of the requirements for an equivalent or higher qualification at any other recognized educational institution.

3.

- I am fully aware of the University of Fort Hare‘s policy on plagiarism and I have taken every precaution to comply with the regulations.

4.

- I am fully aware of the University of Fort Hare‘s policy on research ethics and I have taken every precaution to comply with the regulations. I have obtained an ethical clearance certificate from the University of Fort Hare’s Research Committee and my reference number is the following: **PID031SADA01** (Attached as Appendix A).

5.

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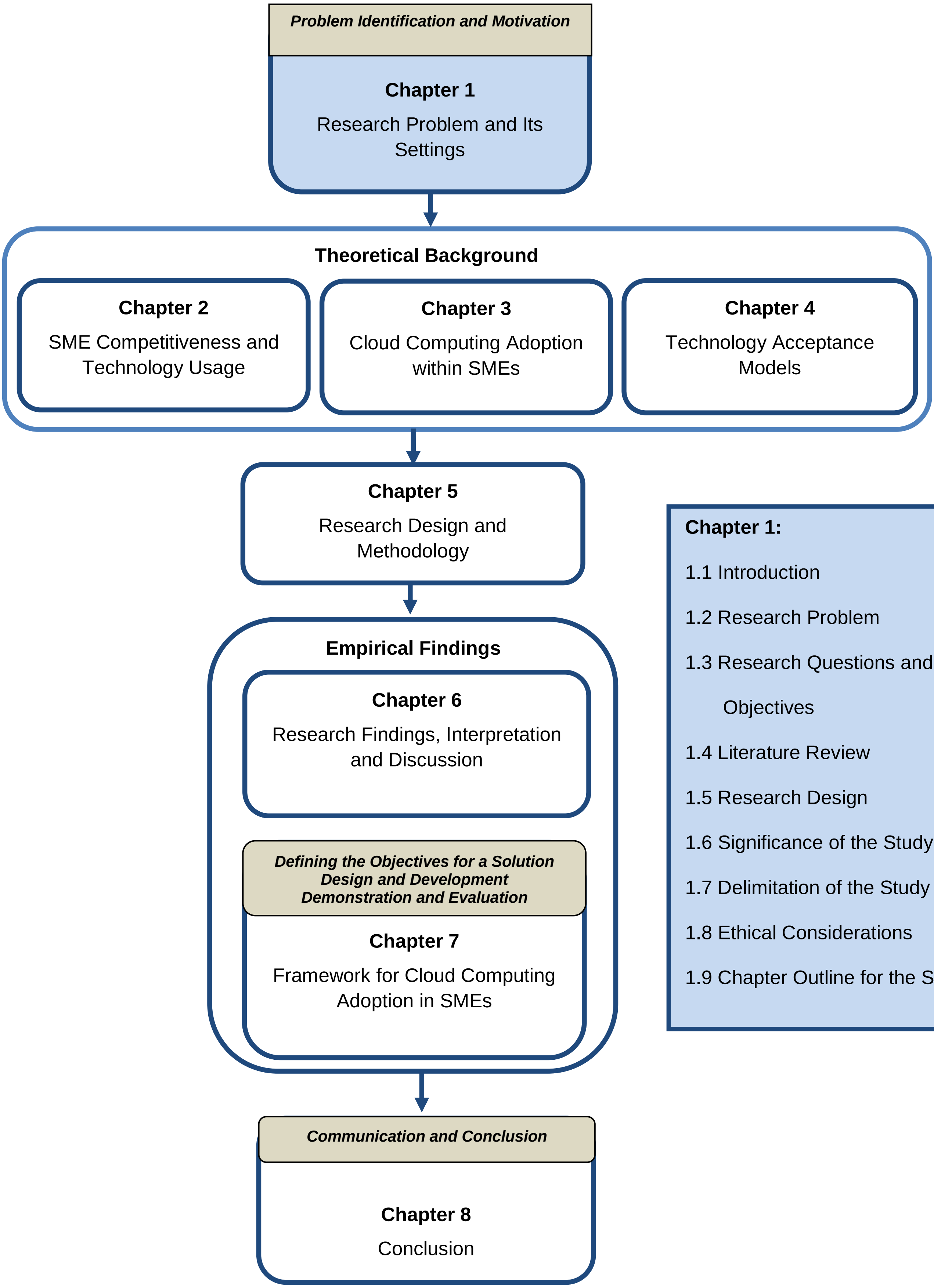

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Chapter 1: Research Problem and Its Setting

1.1 Introduction

Small and medium-sized enterprises (SMEs) are key to the socio-economic development of many countries around the world. Globally, SMEs are estimated to account for about 95% of all registered firms (Aktas, 2010). According to Abor and Quartey (2010), they account for 92% of businesses in Ghana, contributing about 70% of gross domestic product (GDP) to the Ghanaian economy. SMEs are seen as efficient and prolific job creators for the rural and urban labour force, and the seed of big businesses. 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, be 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 Mahmoud (2011) SMEs contribute to the growth of the Ghanaian economy through productivity and innovation.

However, the increasing globalization and rapid technological revolution presents challenges for small businesses to maintain their competitiveness. Therefore, SMEs need to design and implement new strategies, and information technology (IT) is key (Guzman, Torres & Serna, 2015). According to Moghavvemi, Hakimian and Tengku (2012) IT has the potential to improve operational efficiency and effectiveness, and change the way businesses compete to redraw competitive boundaries.

Information and communication technologies (ICTs) are universally recognized as an essential tool for improving competitiveness and also have a significant effect on SME productivity (Oliviera & Martins, 2011). According to Aguilera, Gonzalez and Cueva-Vargas (2015) ICTs have become a catalyst for business processes, becoming a support tool for managing businesses, leveraging developing strategies for achieving competitiveness and innovation in business operation, and bringing sustainability to SMEs over time. ICTs ensure lowered costs of gathering, processing and transmitting business information, and have the potential of increasing market share through the reduction of input costs to allow firms to produce more of the same products, or by producing better quality products (United Nations Conference on Trade and Development (UNCTAD), 2009).

However, the ICT landscape is constantly evolving to create more competitive advantage for businesses and this can be achieved through cost optimization, scalability, flexibility, innovation and agility. These benefits are normally realized through the use of cloud computing (Buyya, Broberg, & Goscinski, 2011). Cloud computing is often considered efficient because it allows firms to free up resources in order to focus on innovation and product development. Vijeikis and Makstutis (2009) point out that IT requirements for SMEs are normally outsourced to allow them to concentrate more on their core business. As a result, cloud computing can serve as an alternative for SMEs. Firms leveraging innovative technologies like cloud computing may find themselves with a competitive advantage if they can evade devastating disasters in the long run. SMEs are therefore increasingly using cloud computing as a means of lowering capital expenses, improving business continuity and making their business operations more responsive (VMWare, 2011). When used properly, the technology can put businesses ahead of their competitors and assist them to respond in-time to the needs of their customers and partners. VMWare (2011) further added that an IT department can assume a more responsive position of handling business needs and begin to be seen as an innovator and driving new business ideas instead of just supporting the existing operations. ICT decision makers therefore need to respond quickly to changing customer and market demands in order to stay ahead of the competition. In addition, they are expected to continue innovating and improve performance while maintaining a focus on efficiency and cost control.

The adoption of cloud computing is a delicate process that requires businesses to have a fair knowledge of some of the factors that influence a successful adoption and hence the need for the development of a cloud computing adoption framework to ensure its successful adoption by small businesses in Ghana. This is widely recognised and highlights the significance of this study. This study proposes a cloud computing adoption framework as the core contribution.

Following the introduction is the underlying problem warranting the study. The formulated primary research questions and sub-questions in tandem with the specific objectives of the study are then presented. Next, a brief literature review of the key concepts of this research study highlights the main topics discussed in the literature chapters. The research methodology and significance of the study are then described. Following this the delimitation of the study, ethical consideration and the chapter outline for this dissertation are described.

1.2 Research Problem

The planning, design, supply chain management, production and distribution of modern manufacturing processes requires the use of ICT (Ministry of Trade and Industry (MOTI), 2011). As a result, only those SMEs which use modern technologies have the opportunity to enter the regional and international markets and remain competitive despite the challenges of globalisation, liberalisation and technical progress. According to Ongori and Migiro (2010), the effect of globalization has put SMEs in a position where they are left with no other choice than to embrace ICT if they are to survive the current competitive era. There is therefore the need for SMEs to be strengthened by improving their access to technology.

The problem investigated in this study is that in Ghana even though SMEs form significant industry segments and account for the majority share in employment, they mostly use outdated technology and have a limited capital and human resource base. This has resulted in their inability to adopt and use technology for innovation that leads to improved productivity and an increased ability to compete (MOTI, 2011). This assertion is justified by Yeboah-Boateng and Essandoh (2014) who attribute the low rate of adoption of new ICTs by SMEs to poor ICT skills, high cost, and the risk associated with investing in ICT. However, a new paradigm in computing, namely cloud computing, present an alternative for addressing the challenges SMEs face in adopting technological innovations. There is therefore the need to explore the technology and some of the drivers and concerns that revolve around the adoption of this technology by SMEs, if they are to be adopted by SMEs in Ghana as a business strategy to help them stay more competitive. The following research questions were therefore investigated in relation to this research problem.

1.3 Research Questions and Objectives

To address the research problem stated above, the following research question was investigated:

How can a framework assist small and medium-sized enterprises in their adoption of cloud computing in the Accra-Tema metropolis of Ghana?

The sub-questions that arose from the primary research question include:

1. *How can the adoption of cloud computing improve information practices in small and medium-sized enterprises in the Accra-Tema metropolis of Ghana?*
2. *What are the required factors for a framework to support the adoption of cloud computing by small and medium-size enterprises in the Accra-Tema metropolis of Ghana?*
3. *What inhibits small and medium-size enterprises from adopting cloud technology as a competitive tool?*

In order to address the research questions above, the following primary objective was considered:

To propose a framework for cloud computing adoption by small and medium-sized enterprises in the Accra-Tema metropolis of Ghana.

The primary objective was achieved through the following secondary objectives:

1. *To investigate the adoption of cloud computing to improve information practices for small and medium-sized enterprises in the Accra-Tema metropolis of Ghana.*
2. *To investigate the required factors for a framework to support cloud computing adoption by small and medium-sized enterprises in the Accra-Tema metropolis of Ghana.*
3. *To investigate the stumbling blocks for small and medium-sized enterprises when they decide to adopt cloud technology as a competitive tool.*

Having outlined the research questions and objectives of the current study, the next section discusses the theoretical foundation of this study and related literature.

1.4 Literature Review

This section discusses the literature sources relating to the underlying theories of the study. The Technology Acceptance Model (TAM) proposed by Davis (1986) and Confidentiality, Integrity and Availability) CIA triad by Steichen (2010) provides the theoretical framework for this study.

1.4.1 Underlying Theories

TAM was developed from the Theory of Reasoned Action (TRA) by Davis (1986) to explain the determinants of technology adoption and usage and also the behaviour of users of computing technologies. Normally, a model is expected to predict and explain the suitability, or otherwise, of a system and suggest appropriate ways of using such a system. It is for this reason that TAM was developed for investigating the effect of external factors and internal beliefs, attitudes and intentions. TAM proposed two ideas, namely: perceived usefulness and perceived ease of use as relevant to behaviour towards accepting technology. Perceived usefulness is a user's subjective belief that using a system will improve performance within an organization; while perceived ease of use refers to the prospective user's expectation of the system to be free of effort (Davis, 1989).

In their study to explain behavioural intention in a procurement environment, Gentry and Calantone (2002) established that TAM is ideal for explaining variance in behavioural intentions. They argue this is a result of TAM's use of two specific beliefs in varying contexts. Benamati and Rajkumar (2008) stated that the decision to outsource IT in organizations is usually made by single individuals at executive levels. Thus the use of TAM, which is developed to gather views of individuals, is appropriate to evaluate acceptance of certain organization-wide technology decisions (Benamati & Rajkumar, 2008).

Although TAM has successfully been used to explain technology adoption and usage, there has been the issue of its appropriateness and comprehensiveness. Some researchers have questioned the assumption that the two elements are the only key determinants of technology acceptance (Park, Lee & Cheong, 2007). Davis (1989) contends that there is the need for research aimed at identifying more determinants that may have an effect on these two key determinants, as this has the potential of improving the model's effectiveness at explaining the acceptance of technology. As a result, scholars concluded that TAM is limited and therefore there is a need to include other variables to better explain the behavioural intention to accept and use technology (López-Nicolás, Molina-Castilllo & Bouwman, 2008). Venkatesh, Morris, Davis and Davis (2003) stated that unlike TRA, TAM's final conceptualization excludes the attitude element as an attempt to describe intention. As a result of these criticisms, new determinants are constantly being added to TAM. A more detailed description of this theory is provided in chapter 4.

The CIA Triad is an industry-accepted model for ensuring security in systems (Steichen, 2010). It place emphases on the storage and management of data. Confidentiality, integrity and availability become an issue when transferring data across the Internet. These three factors present important user concerns when it comes to the adoption of cloud computing. The CIA Triad is discussed in more detail in chapter 4.

The next section explains the uniqueness of the current study in relation to other cloud computing adoption frameworks.

1.4.2 Uniqueness of the Current Study in Relation to other Cloud Computing Frameworks

In the adoption of technology, there is the need for the alignment of the objectives of the organization's IT strategy with business strategy to ensure effectiveness and overall business performance. Specifically for the adoption of cloud computing, Conway and Curry (2012) stressed the need to determine the organization's IT objectives, including the role of cloud computing within the IT strategy; understanding, managing and controlling the impact on the business; aligning these objectives with business needs; and strategically planning the transition to the cloud environment.

Chakraborty ,Islam, Kabir and Hossain (2015) proposed a framework to help private and public sector organizations in developing countries to adopt cloud computing opportunities and prevent its obstacles. The framework introduced a systematic and integrated cloud computing adoption strategy to help introduce the benefits and opportunities critical for organizations. Islam, et al's (2015) framework provides four phases of adoption and implementation of cloud computing. The first phase recommended three key factors to consider, namely: resource feasibility, operational feasibility and economic feasibility. The second phase took into consideration the planning of the needed platform for the transition to the cloud. They recommended the involvement of some technical and managerial activities to prepare organizations to adopt cloud computing services. The third phase is the implementation of the appropriate cloud infrastructure; and the final phase is the continuous renewal of all monitoring activities to help solve problems associated with cloud computing adoption. Islam, et al's (2015) framework was provided to prepare a decision making framework for cloud computing adoption and implementation.

In another study**,** Loebbecke, Thomas and Ulrich (2012) developed a cloud readiness model with one of its central tenets as the need for businesses to make informed, strategic decisions pertaining to IT services suitable to migrate to the cloud environment. This they recognised is needed to avoid operational cost and any potential negative effect on business strategy. The IT service selection process according to Loebbecke et al. (2012) consists of "identification, screening and categorization" phases. These phases involve: identifying those IT services that need extra assessment to be sure of their readiness to move to the cloud and establishing cloud-readiness assessment criteria appropriate to the firm's context; evaluating the identified IT services against the assessment criteria and identifying which of the criteria are most crucial; and establishing an easy starting point to separate IT services which are "likely cloud environment ready" from those that are "not yet cloud environment ready".

Although the tenets of both frameworks are applicable in the developing country context, both are decision making frameworks for the adoption of cloud computing and need improvement to suit the Ghanaian context. While Islam, et al (2015) provides guidelines for making effective decisions about cloud computing adoption and implementation, Loebbecke et al's (2012) model was developed to help make strategic decisions about the IT service to migrate to the cloud environment. Such adoption strategies may not necessarily work for Ghanaian SMEs. In developing countries like Ghana, cloud computing is still in its infancy (Kshetri, 2013), and information about its adoption is scant. SMEs are therefore not able to make informed, strategic decisions about the sort of services to move to the cloud.

According to Hinson and Sorenson (2007), Ghana still falls behind other countries in the use of emerging technologies because of the lack of strategy to harness the full potential of ICTs for the socio-economic development of the country. Perhaps when SMEs are made to understand the impact of cloud computing on their business, they will be better placed to make effective decisions on adoption. Secondly, while others meet the minimum requirements for advanced cloud services, Ghana falls in the category of countries which meet the minimum requirements for basic cloud services (United Nations Conference on Trade and Development (UNCTAD), 2013). Therefore technologies that work for SMEs in some countries may not necessarily work for SMEs in Ghana. There is therefore the need for a specific framework that takes into consideration the current state of Ghana in relation to cloud computing.

The current research project is therefore unique to the Ghanaian SME sector as it adapts some aspects of the above frameworks and also emphasizes the extent of the impact from the adoption of this emerging technology for SMEs in Ghana who stand to gain considerably from this computing paradigm. This aspect is not well defined in the above frameworks. The absence of literature on conceptual frameworks or theories assessing the impact supports this view (Adam & Musah, 2015). There is also no known cloud computing adoption framework specifically tailored for the SME sector in Ghana. This further motivates the need for this research and the uniqueness of its contribution. The next section briefly outlines the research design adopted in studying the research problem.

1.5 Research Design

This study used the design science methodology. Design science is a problem solving technique that strives for the creation and evaluation of an ICT artefact to solve an identified organizational problem (Hevner, March, Park & Ram, 2004). The problem according to Hevner and Chatterjee (2010) is the ill-defined environmental contexts, creativity and teamwork to yield effective solutions. Hevner, *et al.* (2004) further state that design science seeks to create innovations that explain ideas, practices, products and technical capabilities through which the analysis, design, implementation, management and use of information systems can be achieved. Human-beings create the artefact in design science research for practical purposes. For this research study, the artefact will be a proposed framework for cloud computing adoption by SMEs.

The study reviewed recent literature on cloud computing from secondary sources including the analysis of frameworks, cloud computing guidelines and other related articles. This literature review informed the creation of the research instrument, namely the questionnaire and interview guide, and consequently, the proposed artefact (framework). As an iterative validation step is required in the design science methodology, the artefact was validated through three rounds of expert review. Figure 1.1 shows a diagrammatical representation of the research strategy that will be used for this study.

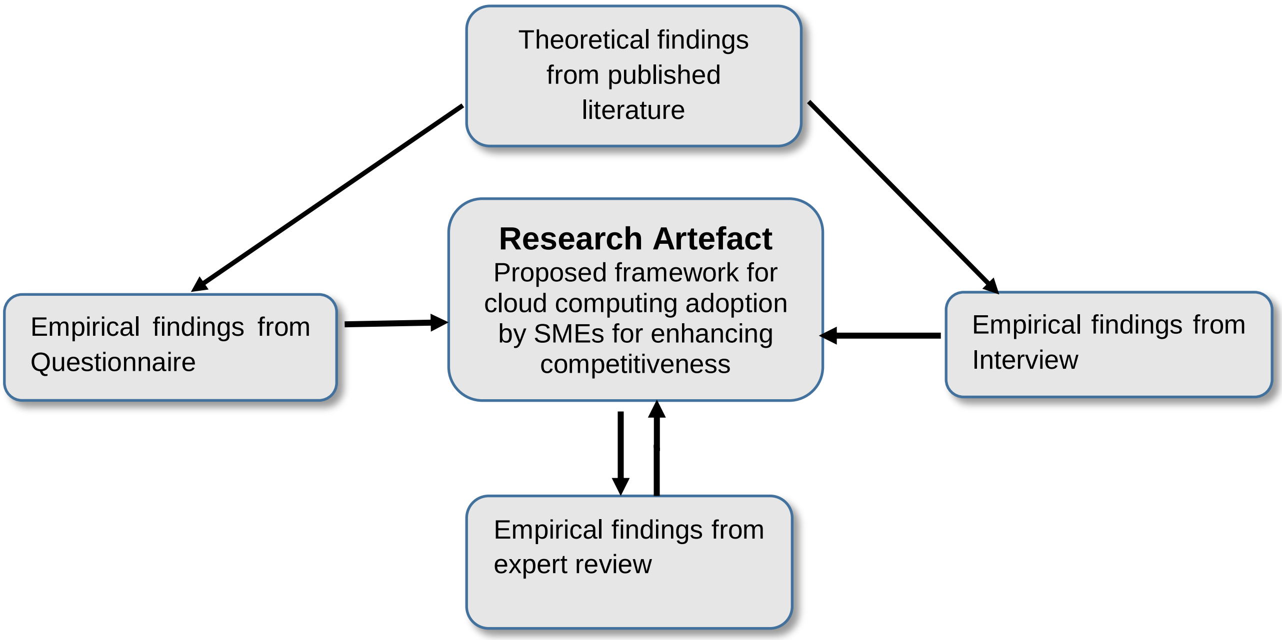


Figure 1.1: Research Strategy for the Study (Source: Own Creation)

This is the research strategy that was followed throughout this study. An outline of the choice of research paradigm, research methodology, data collection methods, data analysis methods and the sample and population of the study are presented in the sections that follow.

1.5.1 Research Paradigm

A research paradigm is a framework of guidelines that indicates how a research study will be conducted. Hofstee (2006) argues the need for academic research to have an underlying philosophical paradigm. This gives an idea of the shared way of thinking to which the research is aligned. Several philosophical paradigms exist due to the existence of different ideas, views and perspectives of the world (Hofstee, 2006). These are categorised into positivism, interpretivism and critical postmodernism. Furthermore, mixtures of paradigms have resulted in pragmatism (Tashakkori & Teddlie, 1998).

This study will be grounded in the pragmatic paradigm for a number of reasons. The study aims to develop a framework and will use the design science approach. Since pragmatism seeks to develop practical applications, it resonates well with the goals of design science. Additionally, pragmatism uses a pluralistic technique by rejecting an in-compatibilist method that provides options to the researcher to select a mix of methodologies that aims to solve the identified problem (Johnson & Onwuegbuzie, 2004; Levy & Hirschheim, 2012).

The use of multiple research paradigms is gradually becoming popular (Mingers, 2001; Orlikowski & Baroudi, 1991; Patterson & Williams, 1998), as this leads to better and more reliable research findings as well as creativity (Mingers, 2003; Saunders, 2007). The socio-technical nature of Information Systems (IS) research makes this assertion true as both the domain and research processes are complex and multi-dimensional (Gregor, 2006; Mingers, 2003).

As a result, the study will employ another paradigm, interpretivism, to the data collected from the interview. The interview will focus on gaining better insight into the operations of SMEs in the Ghanaian context by assuming an empathetic position and not imposing an understanding and perception on the situation. Interpretivism will be used to interpret the findings and results to gain an understanding of how cloud computing technology adoption can influence their business operations positively or negatively in their quest to attain competitive advantage.

In this study, the phenomenon under investigation is the adoption of cloud computing by SMEs in Ghana. SMEs in Ghana provide the context and the framework developed as the contribution of this study provides the conclusions. The next section focuses on the research methodology adopted for this study.

1.5.2 Research Methodology

Research methodology is the approach used in the research. Collis and Hussey (2009) describe research methodology as the technique adopted for the research process which includes a number of methods. The choice of method is normally indicative of the aims of the study, availability of time and resources, philosophical assumptions and technique (Saunders, Thornhill & Lewis, 2009).

The design science research guidelines were adopted for this study, leading towards the development of the proposed framework. Hevner, *et al.* (2004) put forward seven guidelines as underlying steps which must be considered when carrying out research using design science. The guidelines and their description are briefly provided in table 1.1 below.

Table 1.1: Design Science Research Guidelines (Source: Hevner, March, Park & Ram, 2004)

Design Science Guidelines	
Guideline	**Description**
Guideline 1: Design as an Artefact	Design-science research must result in the creation of a practical artefact in the form of constructs, models, methods or instantiations.
Guideline 2: Problem Relevance	Design science research aims at building up technology-based solutions to inherent and relevant business problems.
Guideline 3: Design Evaluation	The design artefact has to be thoroughly evaluated through well-executed methods in order to yield utility, quality and usefulness
Guideline 4:	Design science research needs to offer new and acceptable contributions in

Research Contributions	the fields of design artefact, design foundations and/or design methodologies
Guideline 5: Research Rigor	Design science research employs rigorous methods in the construction and evaluation of the design artefact to ensure coherence and consistency.
Guideline 6: Design as a Search Process	The creation of an effective artefact requires consideration of the problem environment and mechanisms that can find an effective solution.
Guideline 7: Communication of Research	Design-science research must be communicated effectively both to technology-oriented as well as management-oriented audiences.

Below are the descriptions of these guidelines as applied in this research study:

1. *Design as an Artefact:* The study explored how SMEs can enhance their competitiveness through the adoption of cloud computing. The final artefact is a framework that can assist SMEs to adopt cloud computing as a competitive tool.

2. *Problem Relevance:* The problem recognized in the study refers to the lack of competition amongst SMEs and how the use of cloud computing can bring about the needed competitiveness.

3. *Design Evaluation:* The framework was evaluated by expert reviewers from technology and SME development domains. Their recommendations were incorporated into the final artefact.

4. *Research Contributions:* The design artefact, namely the framework, is expected to offer a valuable insight into how to use cloud computing technology appropriately in order to make small businesses more competitive.

5. *Research Rigor:* A questionnaire and interview guide were constructed based on themes derived from existing literature and questionnaires found in literature which have been validated previously. This facilitates reliability and efficiency. Experts conducted a thorough assessment and validation of the proposed framework.

6. *Design as a Search Process:* The research questions were answered using a combination of literature survey, existing theories, methodologies and previous studies and primary data obtained from the empirical study. These methods allowed for the use of different sources which led to reliable results.

7. *Communication of Research:* This guideline was followed by the publishing of a journal article. Two further research papers have been written for publication.

1.5.2.1 Data Collection Methods

The instruments used for collecting the data for this study included web-based questionnaires, face-to-face interviews and expert reviews. A critical review of published literature on SMEs and cloud computing informed the development of the questionnaire and interview guide (see appendix B and C). The questionnaires were electronically distributed to SME owners/IT managers in the Accra-Tema Metropolis of Ghana.

The second phase saw the collection of data from participants using a semi-structured interview approach. The interviews were conducted on SME owners and IT managers from selected SMEs. The choice of SME owners was as a result of the fact that they were better placed to know the overall benefits of using a technology-based solution within SMEs. Technology professionals were interviewed as they are in a better position to assess the system, information and service quality constructs (Reichgelt, 2006; Ozkan, 2006).

Opinions from experts in functional areas of the outcome were used to refine and verify the framework developed as a result of the literature review, questionnaire and interviews. According to Skulmoski, Hartman and Krahn (2007) the required information is obtained through a series of data collection and analysis techniques interspersed with feedback. The next section therefore discusses the data analysis methods used for the collected data.

1.5.2.2 Data Analysis Method

Data analysis is a critical stage in any research process. According to Mouton (2005), it is the process of reducing data into manageable themes, patterns, trends and relationships. Data analysis seeks to introduce a better understanding of all the different elements of collected data by assessing all the identified relationships between concepts, constructs or variables, and to identify any trends in the data.

For this study, the survey gathered both quantitative and qualitative data. Hence, the data analysis took into consideration both research methods in deciding the type of data analysis to use (Curran & Blackburn, 2001). Additionally, data was gathered from experts in the field of SME development and technology, and from literature.

The analysis of the quantitative data involved two major steps namely: data preparation and descriptive statistics. The process of data preparation begins with editing, followed by coding and finally entering the data into the computer which then transformed the data into a database structure. Descriptive statistics was then employed to explain the basic features of the data collected to help show it in a summarized form. The qualitative data was analysed using thematic analysis. This approach allowed for the reporting of experiences of the participants gathered during the interview process. Feedback from the expert review was incorporated and helped in the refinement of the proposed framework.

1.5.2.3 Sample and Population

One of the challenges likely to be encountered when undertaking research involving SMEs is the selection of an appropriate sample. Sampling is done by selecting some elements from a population from which conclusions can be drawn about the entire population (Cooper & Schindler, 2008). The sample chosen for a study must therefore reveal the characteristics of the entire population to achieve a representation of the population.

In any research, it is ideal to select and test the whole population, but in most cases, the population is too large to include all individuals. The sampling strategy and sample size used in research can therefore be affected by the availability of resources (Saunders *et al*, 2009). This research study's limitations concern financial support and time availability for data collection and analysis. It is therefore impractical to collect data from the entire population and hence the usage of a sample strategy is essential. This study adopted the formula by Survey System (2012) as shown below to produce a sample size reflective of the entire population and with some level of precision:

$$ss = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where ss= sample size, p = population proportion, Z = confidence level usually set at 95% and C = confidence interval. With the unavailability of a pilot study or previous research study, it is not possible to estimate p and therefore for this study, p is given the default value of 0.5 to obtain a conservative sample size estimate. The confidence interval, C, is normally set at 0.05 and refers to the range for the unknown value. Using the formula, a total of 384 SMEs were selected through a convenience sampling technique to respond to the questionnaire. Out of this number, 261 responded. This gives a response rate of 68% and according to Oates (2008) though it is common to have a response rate of 10% in a research study, a response rate of 30% or more is usually preferred. Hence the response rate of 68% can be considered appropriate for this study. The sample for the interview consisted of 11 SME participants. This sample size was used for the interview phase of the study as upon analyzing the data of the 11th SME there were no more new themes emerging, in other words, the saturation point had been reached.

1.6 Significance of the Study

A framework can provide an outline of interlinked items which Peng, Su, Chou and Tsai (2009) suggest could be used as a functional guideline according to which initiatives could be carried out. The study contributed to the body of knowledge by developing a framework to assist SMEs to adopt and use cloud computing as a competitive tool. Governmental agencies tasked with ensuring SME growth can strategically use the framework to create and enable the regulatory and policy environment and thereby offer direct provision of financial assistance and technical services to SMEs. The outcome of the study is also beneficial to SME operators by drawing their attention to certain internal processes that can help sustain their growth and improve their competitiveness.

Previous studies have focused on SMEs in more developed countries (Parker & Castelman, 2007), and because SMEs in less developed countries operate in a different organisational context, the applicability of the findings have not been appropriate for less developed contexts. This study thus provides a template with which SMEs in less developed countries, such as Ghana, can use to improve their cloud computing adoption strategies in order to address their unique needs. Cloud computing gives opportunity for businesses to reduce operational as well as capital cost, and provides them flexibility and scalability by way of storage and processing workloads on varied underlying resources (Callewaert & Luysterborg, 2011). Therefore the framework provides an alternative for addressing the challenges they face in adopting technological innovations.

1.7 Delimitation of the Study

The target group identified for this study is small and medium-size enterprises in Ghana. The sample was drawn from SMEs registered with the National Board for Small Scale Industries (NBSSI) in the Accra-Tema Metropolis of Ghana. The study was restricted to SMEs in this metropolis because together they contain the largest number of businesses in Ghana. The next section describes the ethical considerations taken regarding this study.

1.8 Ethical Considerations

An ethical clearance certificate for this study was obtained from the University of Fort Hare (UFH) Ethics Committee (see Appendix A). The issue of confidentiality was maintained by making sure data collected for the study was made available to only the research team. Personal details of respondents were kept anonymous by substituting them with identifiers during analysis. An informed consent form was developed and used during data collection (see Appendix E). The form indicated that the participants are guaranteed certain rights, agree to be involved in the study, and acknowledge their rights are protected. The questionnaires and interviews were conducted with respondents willing to undertake the research and in all cases their consent was sought before administering the questionnaire or conducting the interview.

1.9 Chapter Outline for the Study

Figure 1.2 presents the research chapter arrangement for this study.

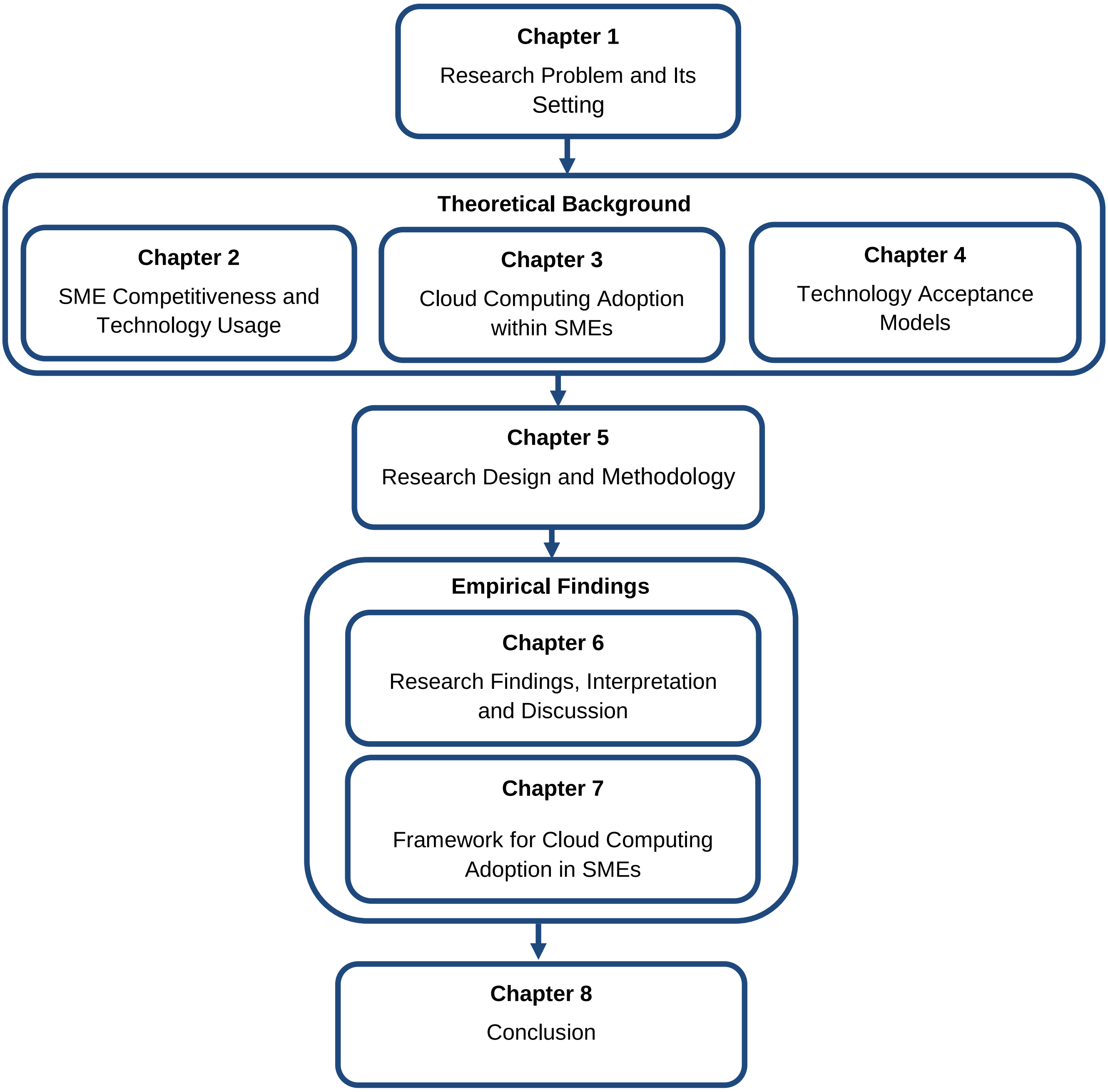
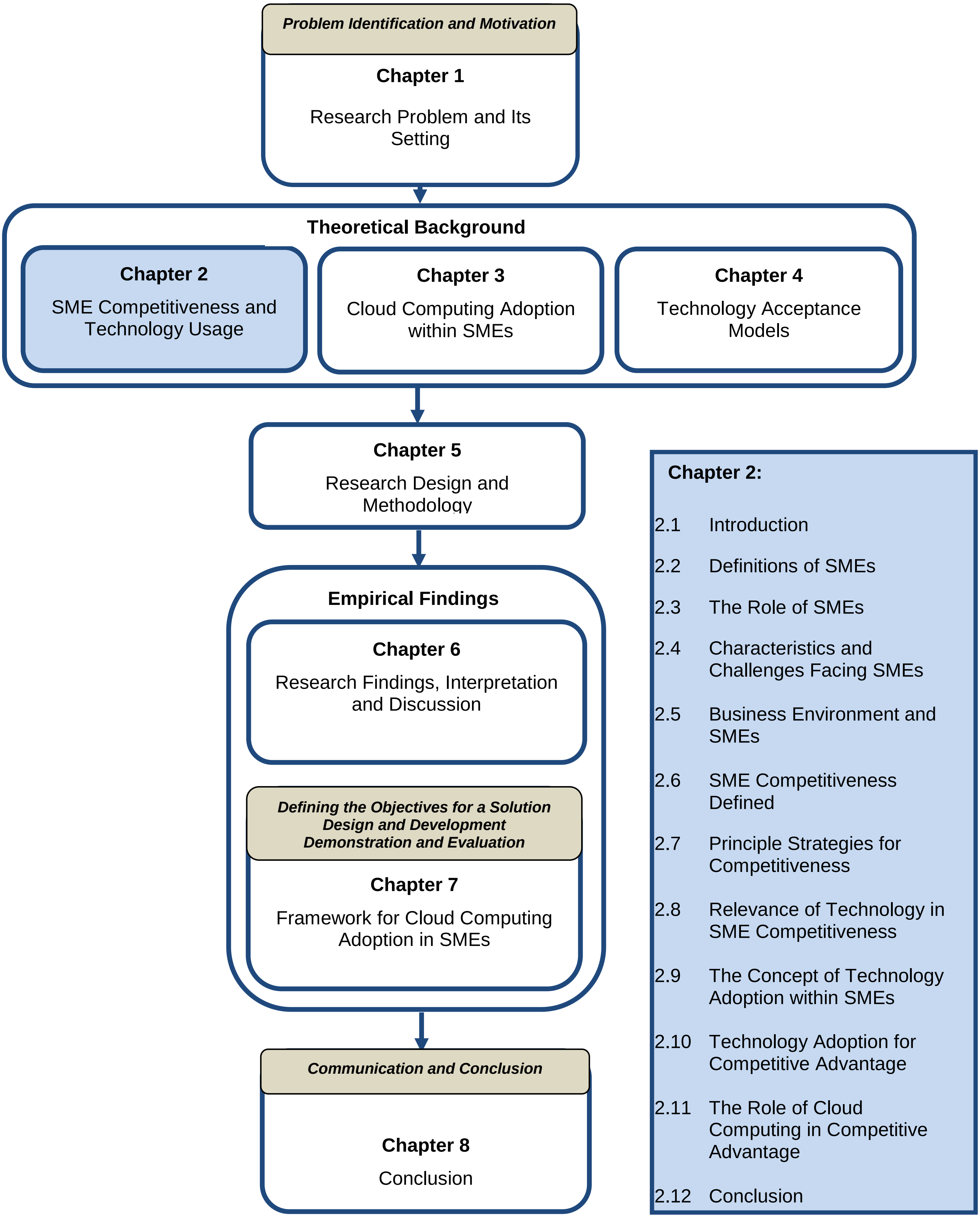


Figure 1.2: Research Chapter Arrangement (Source: Own Creation)

The study starts with chapter 1 which deals with a general overview and presents the research problem and its setting. Chapters 2 and 3 provide a critical review of literature relating to the study. Chapter 2 discusses the underscoring literature in the area of SME competitiveness and their technology usage, while chapter 3 reviews literature concerning cloud computing adoption within SMEs. Chapter 4 provides the theoretical perspectives used to structure the discussion and analysis of this research. It presents a review of relevant literature on technology acceptance models.

Chapter 5 gives the research design and methodology used in the study. Chapter 6 provides the research findings, interpretation and discussions. Chapter 7 details the contribution of this research, namely: the proposed cloud computing adoption framework for SMEs in the Accra-Tema Metropolis of Ghana to enhance their competitiveness. Finally, chapter 8 offers the summary, conclusions and recommendations for further research.


Problem Identification and Motivation
Chapter 1
Research Problem and Its Setting
Theoretical Background
Chapter 2
SME Competitiveness and Technology Usage
Chapter 3
Cloud Computing Adoption within SMEs
Chapter 4
Technology Acceptance Models
Chapter 5
Research Design and Methodology
Empirical Findings
Chapter 6
Research Findings, Interpretation and Discussion
Defining the Objectives for a Solution
Design and Development
Demonstration and Evaluation
Chapter 7
Framework for Cloud Computing Adoption in SMEs
Communication and Conclusion
Chapter 8
Conclusion
Chapter 2:
2.1 Introduction
2.2 Definitions of SMEs
2.3 The Role of SMEs
2.4 Characteristics and Challenges Facing SMEs
2.5 Business Environment and SMEs
2.6 SME Competitiveness Defined
2.7 Principle Strategies for Competitiveness
2.8 Relevance of Technology in SME Competitiveness
2.9 The Concept of Technology Adoption within SMEs
2.10 Technology Adoption for Competitive Advantage
2.11 The Role of Cloud Computing in Competitive Advantage
2.12 Conclusion

Chapter 2: Small and Medium-sized Enterprises Competitiveness and Technology Usage

2.1 Introduction

The small and medium-sized enterprise sector is important to the world economy and has been widely recognized as such. Their flexible nature places them at a better position to create and implement new ideas. SMEs are seen to be innovative by virtue of their flexible nature, simple organizational setup, low risk and accessibility (Al-Mubaraki & Aruna, 2013). This has consequently led to a special interest in the stimulation of entrepreneurial spirit and fostering the growth of small businesses through the implementation of key competitive tools. There is therefore the need for SMEs to change their way of competing from a comparative advantage in terms of low-cost labour; to competitive advantage in terms of the capacity to compete on cost, quality, delivery and flexibility. SMEs also need to reconsider their operational processes and adopt solutions that will help sustain their growth and improve their competitiveness.

This study aims to investigate how SMEs in Ghana can adopt and use technology for innovation and competitive advantage. SMEs in Ghana tend to use outdated technology and have a limited capital and human resource base. It is thus important to provide background into the SME sector, the factors that assist in competitive advantage and the role of technology in this sector.

This chapter reviews literature on SMEs. A discussion of the different definitions of SMEs and their roles follows this introduction. The chapter continues with a review of the characteristics and challenges facing SMEs in general, and in particular those in developing countries. The business environment under which SMEs operate is discussed and thereafter, SME competitiveness and strategies that make SMEs more competitive are discussed. Finally, the role of technology, and specifically cloud computing, in SME competitiveness is discussed.

2.2 Definitions of Small and Medium-sized Enterprises

There are several acceptable definitions for small firms depending on the context in which they find themselves (Culkin & Smith, 2000). There are therefore a range of definitions for what constitutes an SME and this is due to their global diversity and characteristics (Darren & Conrad, 2009). Further, firms differ in their levels of capitalization, sales, employment, geographical area and purpose. Each definition therefore uses a certain criteria. Some criteria use the number of employees, annual turnover or balance total to define SMEs (Burns, 2001). Other defining characteristics of SMEs are: (a) independent ownership and operations, (b) close control by owners or managers who are the main capital contributors and (c) principal decision-making by the owners or managers (Australian Bereau of Statistics (ABS), 2001).

The definitions vary from country to country and thus according to Gunasekaran, Forker and Kobu (2000) the definition should be within the context of the country in which they operate. For example:

1. Table 2.1 gives the United Kingdom (UK) definition of SMEs. They make use of the number of employees, annual turnover and total balance as criteria in the definition.
2. Table 2.2 is the USA definition of SMEs and makes use of only one criteria, namely: the number of employees.
3. In Table 2.3, the total assets, number of employees who pay tax and the turnover of SMEs are used in the definition.
4. The World Bank introduces another criteria, namely: total sales in their definition of SMEs as depicted in Table 2.4.
5. The European Union define SMEs using the same criteria as the UK, as indicated in Table 2.5.
6. Whereas there is no uniform definition for SMEs in Ghana, The National Board for Small Scale Industries (NBSSI) of Ghana defines them according to the number of employees and the total value of fixed assets. This is shown in Table 2.6.

Table 2.1: UK Definition of SMEs (Source: Deakins, 1999)

Criteria	Small Firm	Medium Firm
Turnover	Not more than £2.8 million	Not more than £11.2 million
Balance sheet	Not more than £1.4 million	Not more than £ 5.6 million
Employees	Not more than 5	Not more than 250

Table 2.2: Small Business Administration of the USA Definition of SMEs (Source: Megginson, Byrd & Megginson, 2008)

Criteria	Very Small	Small	Medium	Large
Number of Employees	Less than 20	20-99	100-499	Over 500

Table 2.3: Kenyan Definition of SMEs (Source: Kenya Revenue Authority, 2008)

Criteria	Small and Medium
Number of taxpayers	Not exceeding 50
Turnover	Not more than £10million
Assets	Not more than £10million

Table 2.4: World Bank Definition of SMEs (International Finance Group, 2010)

Criteria	Small	Medium
Number of Employees	Up to 50	Up to 300
Total assets	Up to $ 3 million	Up to $ 15 million
Total sales	Up to $ 3 million	Up to $ 15 million

Table 2.5: EU Definition of SMEs (Source: Burns, 2001)

Criteria	Micro	Small	Medium
Maximum employee	<10	<50	<250
Maximum turnover	≤€2million	≤€10million	≤€50million
Maximum balance sheet	≤€2million	≤€10million	≤€43million

Table 2.6: NBSSI Definition of SMEs for Ghana (Source: Mensah, 2004)

Criteria	Micro	Small	Medium
Number of employee	Up to 5	Up to 29	Up to 99
Total fixed assets	$10,000	$100,000	$1000, 000

It is however important to identify a working definition that can effectively serve the purpose of this study. There is a general consensus from the definitions, on the use of employee head count in defining a small business. This study will adopt the definition of small businesses by the National Board for Small Scale Industries (NBSSI) as this definition is more detailed, specifically with regards to fixed assets.

Even though different definitions exist for SMEs, the enormous role they play cannot be underestimated especially in developing economies (Beck, Demirguc-Kunt, & Levin, 2003; Kashangaki, 2008). The next section discusses the role of SMEs.

2.3 The Role of Small and Medium-sized Enterprises

SMEs are considered to have the potential to bring positive change to the economies of countries with minimal effort and resources (Beck, *et al*, 2003; Agbeibor, 2006). This is particularly important since SMEs usually operate with limited resources. There is therefore the need to invest in this sector to place them in a position to accelerate growth. A common challenge that is usually faced is the uneven distribution of resources together with the uneven growth within their regions of operation (United Nations, 2009; Sanford, 2003). With the wide distribution of SMEs across different sectors, they can serve to ensure the fair distribution of resources and growth.

In developing economies, a high percentage of the population remain unemployed (Todaro & Smith, 2006), resulting in increased poverty levels. Literature has proved that compared to their larger counterparts, SMEs have more employment capabilities, accounting for a significant portion of employment in both developed and developing countries (Beck, *et al,* 2003; Ayyagari, Beck, & Demirguc-Kunt, 2007). This is as a result of the fact that SMEs are labour intensive (Beck, *et al,* 2003), requiring a large personnel to operate effectively. This therefore means SMEs serve as agents of unemployment and poverty eradication.

Developing countries are normally faced with the challenge of low economic growth (Agbeibor, 2006; UN, 2009; Todaro & Smith, 2006). A lot of emphasis has therefore been placed on the contributions of SMEs to the economic growth of countries (Agbeibor, 2006; Kapurubandara, 2009). They play a key role in the in economic growth, contributing significantly to the gross domestic product (GDP) of many economies (Kapurubandara & Lawson, 2007). Hence, SMEs continue to be critical to the socio-economic growth of countries. It is also worth noting that most large organizations usually start as small firms (Ayyagari, *et al,* 2007), making the viability of SMEs crucial to economic development.

In Ghana, the largest contributors to employment are SMEs and they serve as the bedrock of the private sector in Ghana (Kufour, 2008),accounting for about 90 percent of registered firms, 70 percent of GDP and 80 percent of employment in Ghana (Ahiawodzi & Adade, 2012). According to the United Nations World Population Review, Ghana has a population of 26 million and a population growth rate of 2.2 percent (UN, 2014). It is therefore important that the economy grows steadily to accommodate this population. SMEs are important contributors to the growth of Ghana's economy through productivity and innovation (Abor & Quartey, 2010; Mahmoud, 2011). Thus, the SME sector is considered a valve for absorbing unemployed youth in the Ghanaian economy (Mensah, 2004).

Even though several policy frameworks have been implemented to ensure SME development (Agbeibor, 2006; Kapurubandara, 2008; Megginson, *et al* 2008), they are still faced with several challenges (Beck, *et al,* 2003; Ayyagar, *et al,* 2007). Some of the challenges facing SMEs are as a result of their unique characteristics (Megginson, *et al,* 2008). The next section will therefore look at the characteristics of and the challenges facing SMEs. Understanding these challenges will assist in the development of a framework to help SMEs in their quest to stay competitive.

2.4 Characteristics and Challenges Facing SMEs

Even though several definitions of SMEs exist in different countries, they share common characteristics and challenges (MacGregor & Vrazalic, 2005). Kuwayama (2001) identified some of the characteristics and challenges as:

1. *Lack of adequate resources*: Human, financial, technological and knowledge resources are limited among SMEs (Beck, *et al,* 2003). Due to budgetary constraints and the small labour force, employees of most SMEs are forced to multi-task to make up for the skills shortage. Besides this, there is also a lack of the human resources

needed for planning and the development of knowledge (Katz & Green, 2010). Thus, it is difficult for SMEs to recruit or develop the needed human resources and managerial expertise to advance their development (Atkinson & Curtis, 2004).

2. *Mainly operated by owner or manager:* This is a very common characteristic of SMEs (Katz &Green, 2010). The owners usually play the role of managers and are directly involved in the decision making process (Katz & Green, 2010). Most of these owners and managers however, lack the needed managerial skills (Gurau, 2004), resulting in poorly managed SMEs. Additionally, instead of being proactive, SMEs are often reactive in their decisions, tackling only the immediate opportunities and problems (Torres, 2002). This leaves them not fully prepared to handle uncertainties in the business environment.

3. *More flexible:* The small nature of SMEs makes them more flexible, innovative and less bureaucratic than their counterparts (Katz & Green, 2010). This flexibility makes SMEs more adaptive, and as a result, they are able to easily adapt to changing business conditions and customer needs.

4. *Low-technology involvement:* SMEs employ basic technologies in their operations and are often slow to adopt new technology (Parker & Castelman, 2007). This is largely as a result of low capital and the lack of requisite skills. According to Kyobe (2004) the low level of adoption of technology by SMEs has resulted in their inability to realize the strategic possibilities that technology brings.

It can therefore be concluded from the above discussion that the most pressing of the challenges facing SMEs is inadequate resources. With the availability of finance, proper technology and the right knowledge, most of these challenges facing SMEs can be addressed, thereby turning them around and making them more competitive and able to compete with their larger counterparts.

SMEs in developing economies operate under deplorable conditions because of the prevailing environment in their countries (Agbeibor, 2006). One can therefore not assume SMEs in developing economies operate under the same conditions as those in developed economies. These characteristics and challenges can be generalized and since the context of this study is that of the developing economy, it is imperative to discuss the characteristics and challenges faced by SMEs in developing economies.

In their attempt to be more relevant and competitive in the face of changing business climates, SMEs in developing economies often encounter several challenges during their operations. The working environment of developing economies does not provide the needed support to help them face these challenges, but rather presents further complications for the SME sector. This therefore present further challenges and characteristics than those of SMEs in the developed economies discussed previously (Kapurubandara & Lawson, 2007; Kapurubandara, 2008). Some of the further characteristics and challenges experienced by SMEs in developing economies are:

1. They have limited access to funds (Megginson*, et al,* 2008).
2. They have difficulty in accessing and processing the information necessary to communicate their objecives and strategies (International Financial Coorperation, 2007).
3. The unfavourable nature of legal and regulative frameworks leading to the inability to comply with the requirements (Kapurubandara, 2008).
4. Most tend to avoid any form of formal registration (Agbeibor, 2006).
5. Unable to access international markets (Kapurubandara, 2009).
6. Difficulty in attracting and maintaining the right expertise and poor management methods (Kapurubandara & Lawson, 2007).
7. They employ simple and outdated technology (Kapurubandara, 2008).
8. The political, social and cultural settings under which they operate are often unfavourable (UN, 2009).
9. The poor infrastructural system leaves a lasting effect on their operations (IFC, 2007).

While some challenges facing SMEs are attributed to their operations (internal challenges), others originate from external forces to the firm (external challenges) (Katz & Green, 2010). There is often little that management of SMEs can do about external challenges as they fall outside their realm. However, since the internal challenges are inbound, proper planning and strategy can help minimize their effect. Figure 2.1 shows the common internal and external challenges facing SMEs:

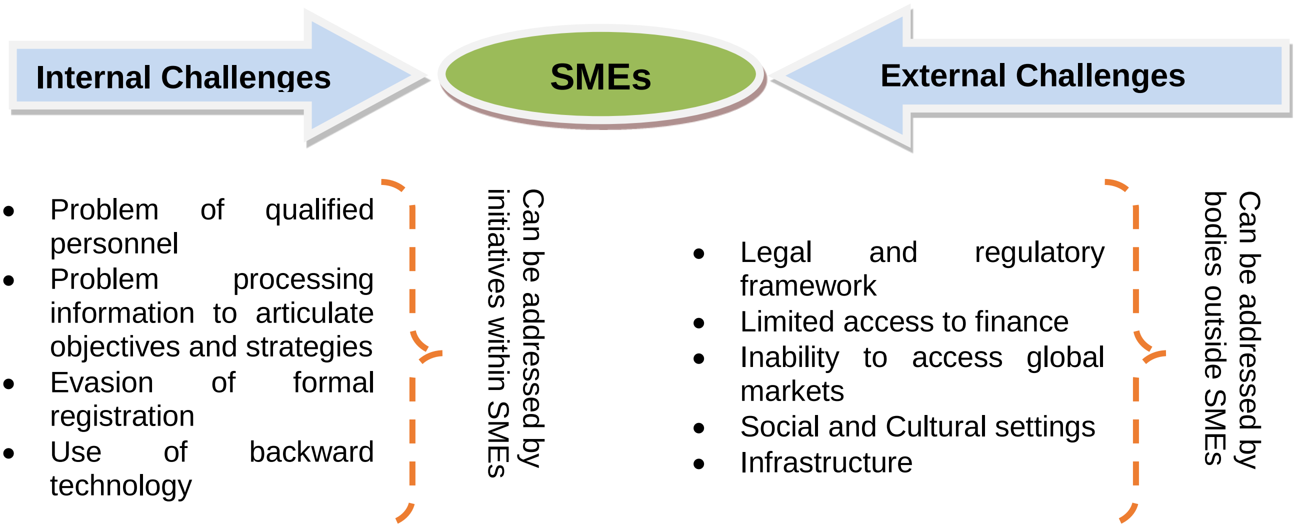


Figure 2.1: Internal and External Challenges Facing SMEs in Developing Economies (Source: Gils, 2000).

There is the need for SMEs to put into action structures that have the potential to provide pragmatic solutions to their internal challenges. However, SMEs in developing economies do not have the needed resources to address the challenges they face (IFC, 2007), and therefore remain vulnerable and less competitive.

Additionally, some of the unique characteristics of SMEs are as a result of their strengths and weaknesses (Gils, 2000; Katz & Green, 2010). It can consequently be agreed that these weaknesses or challenges SMEs face can adequately be addressed by matching the unique characteristic of SMEs to the corresponding weakness or challenge. Table 2.7 below shows the matching of unique SME characteristics against their strength or weakness as provided by Gils (2000):

Table 2.7: Characteristics of SMEs and Associated Strengths and Weakness (Source: Gils, 2000)

Characteristics	**Strengths**
Intertwined ownership and management	Motivated management/Commitment
Integration of tasks in worker, variation and improvisation	Motivated labour
Few hierarchical levels, short communication lines	No bureaucracy, internal flexibility, little filtering of proposals
Few and simple procedures, personal, direct, oral internal communication	Low costs and little distortion of internal communication
Personal and close relations with customers	Capacity for customization
Craftsmanship	Unique or scarce competencies
Tacitness of knowledge	Appropriability
Idiosyncratic perception	Originality of initiative
Characteristics	**Weakness**
Idiosyncratic perception	Unopposed misapprehensions
Tacit knowledge	Limited capacity for absorption of new

	knowledge/technology
Craftsmanship	Technological myopia
Few products and markets	Little spread of risk, limited synergy
Small volume of production	Diseconomies of small scale
No staff functionaries	Lack of functional expertise
Lack of managerial time	Ad hoc management, short term perspective
Great authority and many functions in one hand	Vulnerability to discontinuity of management and staff
Few layers of hierarchy	Limited career opportunities
Low level of abstraction	Lack of information
Product-or technique orientation	Errors in marketing and strategy
Possible lack in finance	Lack of means for growth

Knowledge of the strengths and weaknesses will allow SME owners and managers to better equip themselves with the best strategies to help their firms take full advantage of the unique characteristics that are the source of their competitive advantage. Additionally, a knowledge of the characteristics associated with vulnerability, will help owners and managers to come up with appropriate solutions.

It can be gathered from the above discussions that the business environment, whether internal or external, has a significant influence on the survival of SMEs. A good knowledge of the business environment will therefore be ideal to ensure efficiency and effectiveness in the operation of firms (Worthington & Britton, 2009). The next section will therefore discuss the effect of the business environment on SMEs.

2.5 Business Environment and Small and Medium-sized Enterprises

The business environment can be defined as “anything outside an organization which may affect an organization’s present or future activities” (Kew & Stredwick, 2005:1). It can therefore be concluded that the business environment is dependent on existing conditions in the environment at a particular point in time. Just like larger businesses, small businesses operate in a competitive environment (Megginson, *et al,* 2008). Additionally, research has shown that small businesses operate in a more competitive business environment (Ayyagari, *et al,* 2007). It is therefore essential for the management of SMEs to have a fair knowledge of the business environment and be up-to-date with the business’s place within this environment. This will give a better perspective of business to ensure long term sustainability and future growth (Worthington & Britton, 2009). Furthermore, within the business environment are business resources and opportunities (Worthington & Britton, 2009), which require SMEs to forge closer relationships with other elements within their environments. Figure 2.2 indicates the relationship between the SMEs and the environment.

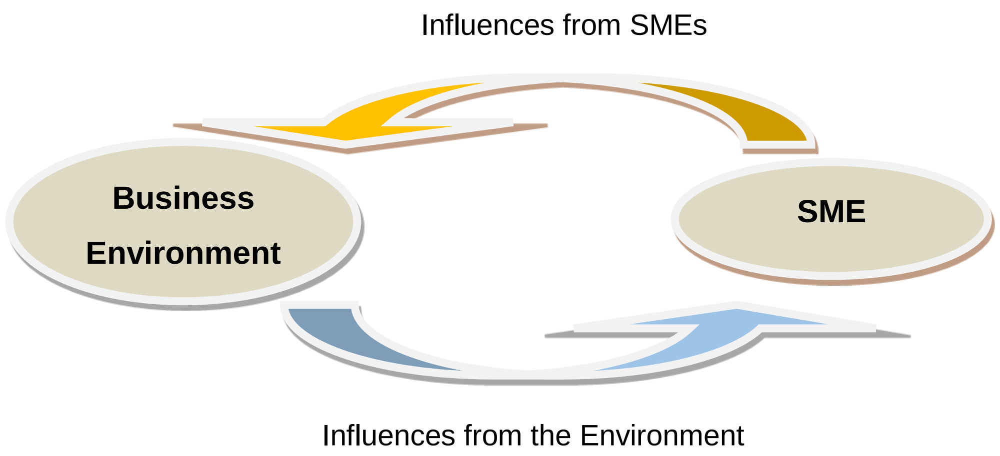


Figure 2.2: Relationship between the SME and the Environment (Adapted from: Worthington & Britton, 2009)

Research has shown that the relationship between the environment and SMEs is key to continued survival in the market (Tyler & Shah, 2006). Any business establishment can be seen as an open system (Katz & Green, 2010; Laudon & Laudon, 2008), that is subject to the effect of the environment due to the relationship between the business and its operating envrionment. The way and manner in which SMEs respond to these environmental factors will determine whether it will fullfil its fullest potential or not (Ayyagari, *et al,* 2007). Therefore, the main factors likely to determine whether SMEs will succeed or fail will come from their external or internal environment and the owners and managers running the business. It is worth noting that the internal factors can be addressed internally by operators but the external factors are often beyond the control of the operators of the SME.

In their assessment of the business environment, Hunger and Wheelen (2010) categorised a typical business environment into three,namely: micro environment, task environment, and macro environment.

The Macro Environment: This is also known as the societal environment and is influenced by the following forces (Worthington & Britton, 2009; Hunger & Wheelen, 2010):

1. Economic forces related to regulating the movement of money, energy, material and information;

2. Socio-cultural forces to do with the regulation of values, ethics, and customs of the society under consideration;

3. Political forces ensuring the assignment and provision of constraining and protecting laws and regulations; and

4. Technological forces that recommend pragmatic solutions to solve problems.

As mentioned earlier, external factors are often beyond the control of SME management and may be due to their small size and limited resources. On the contrary, their larger counterparts are better equipped to face these forces (Megginson*, et al,* 2008). While the management of SMEs need to strategically position their firms to reduce the negative effects of external forces, they must also prepare themselves to take advantage of the opportunities that the external environment offer to their businesses.

The Task Environment: This is made up of external factors that affect organizations and are in turn affected by that organization (Worthington & Britton, 2009; Hunger & Wheelen, 2010). Examples of such external factors are: suppliers, creditors, customers, governments, local communities, employees and their unions, trade organizations and special interest groups (Worthington & Britton, 2009; Hunger & Wheelen, 2010).

The two-way nature of these factors can result in a situation where the SMEs struggle to make sure they are not negatively affected by these factors. Worthington and Britton (2009) therefore concluded that special attention must be paid to the factors in both the macro and task environments to ensure they do not severly affect the success of the organization and so that steps can be taken to avoid any eventuality.

The Micro Environment: These are controllable factors that internally affect the operation of an organization (Worthington & Britton, 2009; Hunger & Wheelen, 2010). Factors that determine the internal environment include: management strategy; mission and vision of the organization; corporate culture and values; industrial relations; line and staff relations; work culture; quality control systems; compensation systems; team spirit among employees; and carrier progression among employees (Worthington & Britton, 2009).

Since these factors are controllable, there is the need for SMEs to make sure there is always the existence of favourable conditions in their business environment to ensure a better factor-organization interaction (Hunger & Wheelen, 2010). A closer look at the micro environment factors indicates that factors often experienced in workplaces affect the internal environment. Management of SMEs must make sure factors that have the potential to create an unfavourable internal environment are addressed before they escalate.

SMEs in developing countries often operate in an unfriendly business enironment (Agbeibor, 2006), which is often characterized by: poor political environment; poor regulatory and legal framework; unfavourable social and cultural environment; poor economic conditions; and low technological advancement among others (Ayyagari*, et al*, 2007). SMEs have the sole responsibility of managing its relationship with its environment (Ayyagari*, et al*, 2007). SMEs can choose to be proactive by planning ahead before environmental changes occur or be reactive by adopting a laid back approach to handling situations. It will be ideal for SMEs to be proactive in order to better address environmental concerns.

From the above, it is evident that the severity of the challenges SMEs face in developing economies is greater compared to those in the developed world. It is therefore not possible for SMEs from the two different worlds to compete equally, especially now in the face of globalization where geographical, cultural and trade barriers have been removed, and the use of the Internet for business has increased (Laudon & Laudon, 2008). Therefore, SMEs in developing economies do not only have to contend with domestic competition but also with competition on a global scale. The next section will therefore focus on how SMEs can be more relevant and remain more competitive in the face of globalization.

2.6 Small and Medium-sized Enterprise Competitiveness Defined

Competitiveness, according to Porter (2001), is the ability of a firm, be it public, private, profitable or otherwise, to reach and keep a systematic comparative advantage, to sustain and advance a definite position in the socio-economic environment. Thus, firms have the ability to produce similar products as their rivals at a reduced price and/or deliver products and services that can out-compete those of their rivals. As a result, every firm strives to achieve competitiveness to stay ahead of their competitors.

A firm's competitive advantage depends on its ability, resources, knowledge and attributes (Barney, 2002). Competitiveness does not happen casually or unexpectedly but is created and reached through a long process of combination of new organizational routines that shape the underlying forces of organizational behaviour from customers, competition and the market. Competitiveness is therefore the feature that allows a firm to survive in flooded markets, and if a firm is not competitive it is doomed to fail (Porter, 2000).

The competitiveness of SMEs can be looked at from the view of the firm's potential versus actual performance. These, together, drive SMEs to achieve the needed competitive advantage. It is therefore necessary to understand the drivers of competiveness. A knowledge of these drivers will equip business owners with the toolkit necessary to evaluate and design strategies that would maximise their firm's productivity and competitiveness in their specific operational settings.

Several factors contribute to firm's achieving the needed competitive advantage. These factors stem from the firm's potential (internal environment) and the firm's actual performance (external environment). They help shape the firm's competiveness and play a critical role in changing a firm's potential and actual performance. Figure 2.3 shows the drivers of competiveness.

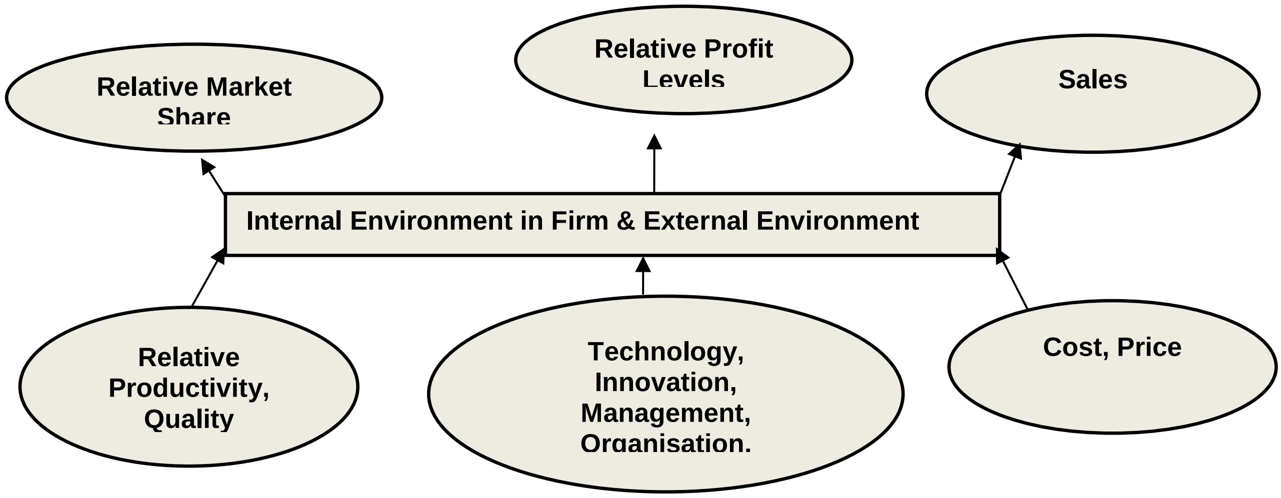


Figure 2.3: Competitiveness Drivers (Source: Szentes, Tamás and Munkákozöössege, 2005)

From the above figure, firms can be considered competitive if there is the combination of at least two of the factors:

1. the price of product
2. the quality and technical value of the products
3. related services (delivery times, packaging, etc.)

A firm becomes competitive if the price of their product is lower than their competitors and this may include their payment terms. Also, if the products are of technical value and of quality, then they tend to be better than those of the competitor's goods and thus enhances their competitiveness. Finally, if a firm's related services are more favourable for the customers than those of the competitors, then it puts the firm at a competitive advantage over their competitors.

It must however be noted that the above criteria are based on factors of price and non-price. There is therefore the need for other criteria to complement them. Szentes *et al*., (2005:112-113) proposed three additional factors:

1. The "lower price" can only be regarded as a "competitive price", if it gives return on the costs for the seller and yields profit.
2. The "higher quality" must include affordable properties and actual value for the customers.

3. Marketability of products and services, is often largely determined by the level of marketing activities (market research, advertising and other marketing communication activities, distribution network).

Additionally, factors that drive competitiveness can be considered at the macro and micro-environment level of the firm. The macro-environment is external in nature and largely influenced by existing conditions in the country where the organization is located. According to Kotler and Keller (2006) the macro-environment encompasses:

1. Demographic environment
2. Economic environment
3. Social and cultural environment
4. Ecological environment
5. Technological environment
6. Political and legal environment

The micro-environment however, concerns external factors that affect competitiveness and originates from the firm’s micro-environment (business or market environment). Porter’s diamond model was used to explain these external factors. In a similar study, Porter proposed another model for explaining the competitive forces in industries and listed five competitive forces. According to Porter (2006), these forces are:

1. Competition between companies which already exist in the industry
2. Threat of new entrants
3. Threat of substitute products
4. Suppliers’ bargaining position
5. Buyers’ bargaining position

According to Dinya and Domán (2004), a firm’s competitive advantage originates from the extent of the competition (competitive force), and the external (and internal factors within a firm which influence the competitive position of the company) causes of competitive advantage. Dinya and Domán (2004) therefore suggested a combination of the Porter’s diamond model and the model for competitive forces. Figure 2.4 shows the integrated model.

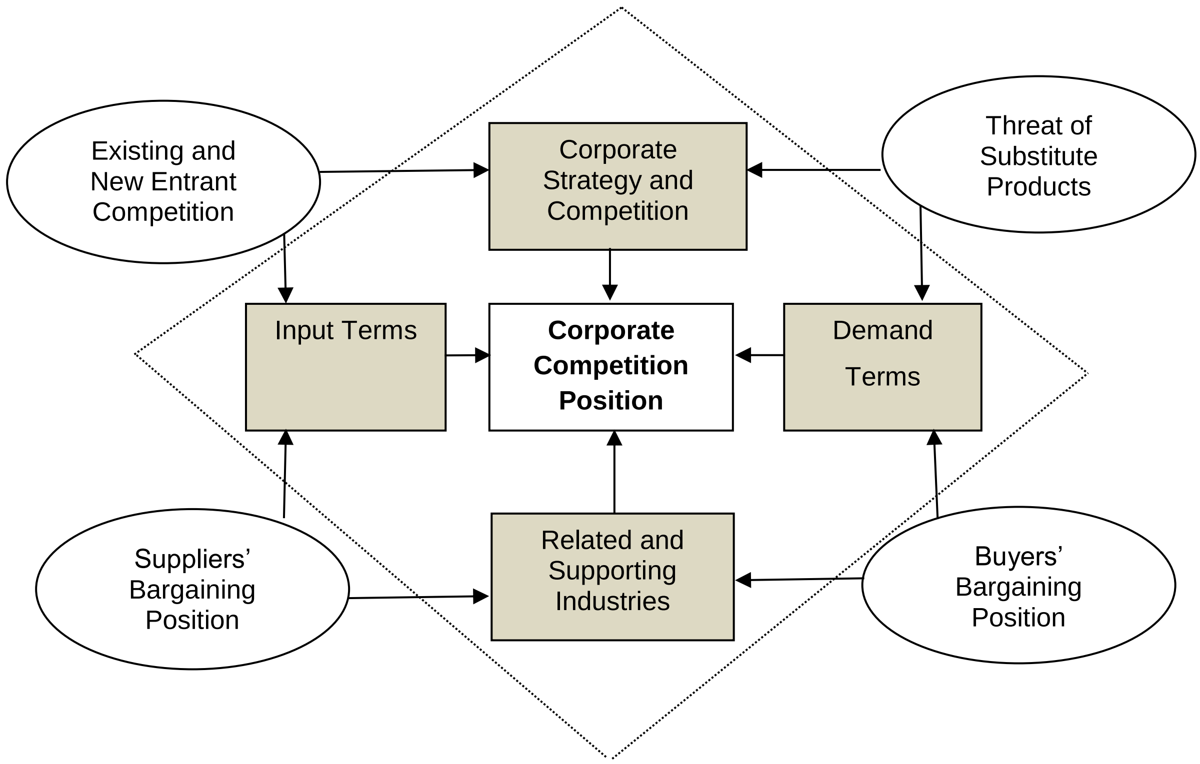


Figure 2.4: Integration of Porter's diamond model and the model of competitive forces (Source: Dinya & Domán, 2004)

From Figure 2.4 it can be noted that the supplier's bargaining position has a direct impact on the firm's acquisition of input terms and makes use of potential competitive advantage present in other firms, especially suppliers. Similarly, the buyer's bargaining position has a direct effect on supporting and related firms through their derivative demand. The existing and new entrant competitors influence the intensity of the whole competition and have a direct impact on input terms. This is because when there is competition on a particular input market, then they are forced to compete for buyers as well as the acquisition of resources. Also, the threat of substitute products affects the intensity of competition by making sure that previous competitors agree in order to ensure their market position. The threat of substitute products can also affect the nature of demand and presents other options for buyers to meet their needs.

In order to remain competitive, firms have to be fast, nimble, flexible, innovative, productive and customer oriented. Hence, firms need to align their objectives with their business strategies. In the next section, the focus will be on the strategies that SMEs can adopt in their quest to gain a competitive advantage.

2.7 Principle Strategies for Competitiveness

Many different definitions exist for a firm's strategy; however, central to all the definitions is the fact that strategy is an action to be taken in the future. Porter (1996) considers strategy as the formation of an exclusive and variable position, comprising a different set of activities. He explained further that the reason for a strategy is choosing to do activities differently from how others do and considering strategic positioning when designing strategies. Barney (2002) also defines strategy as an organization's idea about how to compete successfully. Thus, strategy serves as an overall theme that gives coherence and direction to actions and decisions of an individual or a firm (Grant, 2005). From the previously mentioned five market forces, it can be suggested that there is a need for strategies to attain competitive advantage (Stair & Reynolds, 2012). Some of the strategies are discussed in the sections that follow.

2.7.1 The Innovative Strategy

According to the Organisation for Economic Co-operation and Development (2005), an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in a business practice, workplace organisation or external relation. It involves the introduction of new products and services to meet market demand, adoption of new ways of doing things to improve productivity, applying new marketing techniques to broaden sales opportunities, and integrating new forms of management systems and procedures to enhance operational efficiency (Porter and Stern, 2001).

Madrid-Guijarro, Garcia and Van Auken (2009) identified innovation to be a key determinant of competitiveness among firms. Firms that do not adopt innovation as a business strategy face the risk of being less competitive as a result of their obsolete products and processes. Firms therefore need to engage new knowledge as this helps to produce innovative activity. However, knowledge differs from the usual inputs of labour, capital and land. This is because of the uncertainty that is associated with the value of knowledge and its dependency on economic agents. To most firms, it is unjustifiable to invest in new knowledge as this is viewed as a risky activity. The major source of knowledge is research and development (OECD, 2000a). Other sources include the firm's human capital base.

The empirical relationship between knowledge inputs and innovative outputs is increasingly resilient as the element of concern rises. Developed countries, which turn to be innovative, invest a lot in R&D compared to developing countries which are less innovative. Also the relationship between R&D and new product innovations becomes stronger when the element of concern is industry. Typical innovative industries such as computers, instruments and pharmaceuticals are committed to R&D (Audretsch, 1995). This is however weak in the case of small firms.

The adoption of an innovation strategy by small firms usually starts with a very small output scale. The growth of surviving new entrant firms is dependent on the difference between the level of output and the size of the firm. However, the survival of firms decreases as this gap increases. Firms producing viable products efficiently will grow (OECD, 2000a). Those who do not produce viable products will stagnate, and when conditions are not favourable, they may eventually be forced to exit the industry. Although firms of different sizes continue to operate successfully for long periods of time, it is often not the numbers that matter. Small firms therefore serve as an agent of new ideas and experimentation that would have otherwise been locked up in the economy.

2.7.2 The Information Technology Strategy

This is the strategy that guides the accumulation and deployment of technological resources and capabilities (Dasgupta, Sahay, and Gupta, 2009). When this strategy is adopted by SMEs, they stand a chance of improving their competitiveness in the global market. The adoption of new technologies like the Internet can help businesses increase their productivity. With the introduction of web technologies, SMEs are gradually attaining global marketing capabilities at a reduced cost. Others have also adopted e-commerce and Internet-based technologies as a way of gaining access to financial and accounting management applications that increases the capabilities of firms and reduces the cost of operation. The online services help firms to create product warehouses, leading to the establishment of direct links between firms and their customers. SMEs therefore have to change their organizational structures in order to harness the full potential of these new technologies.

According to Ba, Whinson and Zhang (1999) in the physical world, scale economy and standardization play a major role. The digital world enables individual product customization. The customers will directly interact only with the intermediary, which provides the appearance of having a huge inventory of a wide range of products. SMEs can adopt technology to improve core competencies and coordinate their activities with their counterparts to develop innovative content that will better suit the unique needs of each customer.

2.7.3 The Network and Cluster Strategy

SMEs need to network and cooperate with other firms if they are to remain competitive in global markets. SMEs found in clusters and networks are normally more competitive and innovative than their counterparts operating in isolation (OECD, 2000b). Clusters can be categorized as formal or informal depending on the level of organization. Networking among SMEs enables them to make use of advantages and flexibility with economies of scale and scope in larger markets. According to Porter (1990) many firms working together produce greater competition for new ideas. The level of the inter-firms association largely impact on competitiveness. The association allows firms to co-produce, co-market, co-purchase, and co-operate in new product developments or share information. The structure of the network typically allows firms to reduce costs and elevates innovation through cooperation with other firms.

It must however be noted that, even though networking is an important strategy especially for firms of small sizes, these learning experiences are seen to be of particular importance to firms if they are to offset the vulnerability of size acting as a major determinant of organizational success. According to Pecas and Henriques (2006) the association between universities and SMEs should be concentrated on small projects. These projects must be focused on identified existing problems in the industries.

2.7.4 The Flexibility Strategy

Another strategy applied to help SMEs remain competitive in the global market is to be flexible and change direction at low cost. Due to their unique nature, SMEs provide good options for creating significant productivity gains in the global marketplace due to their ability to change quickly to market dynamics. Jones and Tilley (2003) point out that the flexible nature of SMEs serve as an important agent of competitive advantage. The flexible nature of SMEs makes them very responsive to customer needs and this serves as a means of competing with larger firms. According to Halberg (2000) SMEs are more innovative than their larger counterparts. However, due to the limited resources available to SMEs, it takes longer for them to come out with innovative products compared to larger firms.

2.7.5 The Foreign Direct Investment Strategy

SMEs require access to international markets to ensure their development and growth (OECD, 2002). Foreign direct investment as a strategy for the promotion of small business competitiveness can be influenced by three fundamental factors (OECD, 2000a). Firstly, small firms need to prove to be superior in their capabilities in foreign markets compared to the firms found in those countries. Secondly, the benefits the SMEs gain as a result of the exploit of the ownership advantages must be more than those it stands to gain if it chose to sell or license them to foreign firms instead. Finally, the inclusion of resources from the home country makes production advantageous abroad. The benefits of expanding markets, exposure to different customer demands and networking with foreign firms offer SMEs the strategy to help them remain innovative in a global economy.

When these strategies are adopted by businesses, they stand a chance of achieving the needed competitive advantage. The next section therefore discusses competitive advantage and, in particular, technology-enabled competitive advantage.

2.8 Relevance of Technology in Small and Medium-sized Enterprise Competitiveness

As a result of globalization, there has been a growing need for new opportunities that will help increase competition in the markets (D'Atri & Sacca, 2009). These factors greatly influence SMEs and their operations (Bannock, 2005). There is therefore the need for SMEs to re-examine their internal processes and find solutions to problems to help them stay relevant and be more competitive. As discussed earlier, SMEs are faced with several problems, especially those in developing countries, which hinder their attempt to be relevant and achieve competitiveness (Puppim de Oliveira, 2008).

Research has shown that investing in technology has the potential to increase productivity (Bannock, 2005; Katz & Green, 2010; D'Atri & Sacca, 2009). There is therefore the urgent need for SMEs to capitalize and “take advantage of IT in order to support its operations, add value to its products and services, and gain competitive edge in the market place” (Stylianou & Kumar, 2000:99).

SMEs adopt technology as a business strategy in order to yield the needed competitive advantage on their technology investment (Levy & Powell, 2005). There is therefore the need to fit technology into the SMEs objective of gaining competitive advantage. Competitive advantage may be achieved by capitalizing on the opportunities technology offers through its three basic roles of: automation, information and transformation (Laudon & Laudon, 2009). When human skill is replaced by technology, that technology is said to have an automated process. Similarly, when human skill is complemented by technology, the technology is said to have informed the process. Finally, when technology reorganizes, the technology changes or transforms a set of processes.

From Porter’s competitive forces model (Laudon & Laudon, 2009) the success or failure of a business is dependent on its ability to react to its external environment. This implies that the possibility of achieving competitive advantage by any business strongly depends on their ability to respond to the five competitive forces as outlined by Porter (Laudon & Laudon, 2009). Figure 2.5 shows the five external forces that every business must compete with at any point in time.

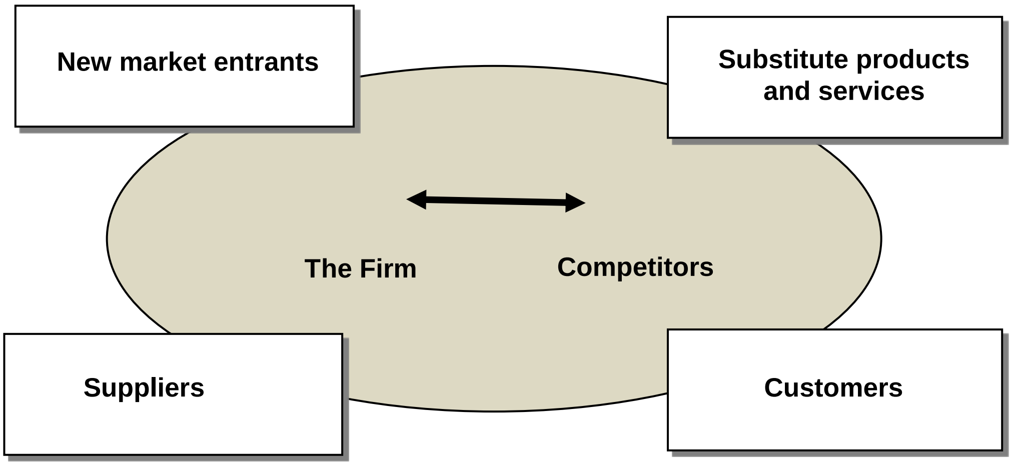


Figure 2.5: Porter's Competitive Forces Model (Source: Laudon & Laudon, 2009)

According to Laudon and Laudon (2009), the external factors include:

1. *Competitors:* These are firms in the same business or same market and often compete against each other by continuously devising new products, services, efficiencies and switching costs.

2. *New market entrants:* These are new firms that have entered a particular market or business and produce similar or substitute products or services.

3. *Substitute products and services:* There is usually the existence of similar or substitute products and services within a market and usually offered by competitors, and based on their quality or price, customers can decide to choose them.

4. *Customers:* They are potential buyers of a product or users of a service in a given market. When they have access to enough information, customers can make informed decisions as to what product or service they want.

5. *Suppliers:* They are units that supply goods or services to the firm.

Several studies have provided evidence to show that when SMEs use technology effectively and efficiently they stand a chance of responding positively to the external factors (Ayyagari, *et al,* 2007; Katz & Green, 2010). The use of technology by SMEs to respond to external factors and consequently achieve competitive advantage can be enhanced through the use of any of these approaches (D'Atri & Sacca, 2009):

1. *Low-cost leadership:* The operational cost of organizations can be reduced when technology is employed and this may result in lower prices of products and services. This leads to lower prices of products and services than their perennial competitors

and new entrants. The reduced operational cost will allow SMEs to operate in local markets and expand to regional and international markets. Money accrued from the use of technology can be used to tackle other pressing issues related to the organization.

2. *Product differentiation:* The use of technology by SMEs enables the production of new products and services and thereby changes customer convenience and experience. There is mass customization of products and services.

3. *Focus on market niche:* SMEs can focus on a narrow market segment and use technology to collect specific information about its customer and as result, meet the unique needs of customers.

4. *Strengthening customer and supplier intimacy:* Supplier intimacy can be enhanced through the use of Supply Chain Management (SCM) systems. Similarly, the use of Customer Relationship Management (CRM) systems can help build customer relationship. SMEs can therefore use technology to develop strong ties and loyalty with customers and suppliers. It increases switching costs.

SMEs can make technology a business strategy and tap the advantages they bring, to achieve a competitive advantage. The small size and flexible nature of SMEs also means the non-requirement of complex infrastructure for the diffusion and application of technology (Datta, 2007), and easy adoption of new technology.

2.9 The Concept of Technology Adoption within Small and Medium-sized Enterprises

SMEs usually operate under limited resources (Katz & Green, 2010), resulting in their reluctance to invest in technology. A few invest in technologies that allow them to simply automate simple processes (Dhillon, Stahl, & Baskerville, 2009), since this requires little financial and infrastructural resources (D’Atri & Sacca, 2009; Laudon & Laudon, 2009).

As the enormous benefits of using a technology become evident, SME operators begin to trust the technology and are ready to invest further in it (Bannock, 2005; Duncombe & Molla, 2009). This results in SME management further exploring other opportunities the technology can offer their business (Dhillon *et al.,* 2009). The enthusiasm to use and the massive opportunities technology offer has leveraged the competitiveness of SMEs that use various technologies in their operations. As a result, many SMEs are starting to see technology as a strategic tool for attaining the needed competitive advantage, and more SME operators are gradually involving themselves directly with technology (Megginson, *et al* 2008).

According to Dhillon *et al,* (2009), SMEs use technology for several reasons, some of which can be summarised as follows:

1. To streamline their operations by redesigning their business processes to eliminate redundant processes;
2. Reducing cost significantly by cutting down information processing costs and improving reliability;
3. Improving decision making by making quality information available;
4. Improving quality of their products and services;
5. Increasing revenue; and
6. Allowing SMEs to survive in highly competitive markets.

The rate of usage of a technology is dependent on the growth stage of the SME (D'Atri & Sacca, 2009). Churchill and Lewis (1983) identified the following stages in the growth of an SME: existence, survival, success, take-off, and resource maturity. SMEs face different challenges that they need to overcome in their attempt to move from one stage of growth to another (Katz & Green, 2010). The main challenge at the existence stage is to attract customers for the firm (Katz & Green, 2010), as they mostly have no formal systems and rarely invest in technology at this stage. As the firm grows, organisational structures are put in place and they begin to deploy technological systems for some of their basic tasks (Katz & Green, 2010; D'Atri & Sacca, 2009). As firms reach resource maturity, advanced technologies are deployed (Katz & Green, 2010; D'Atri & Sacca, 2009).

From the above, it is evident that SMEs operate under limited resources and therefore this affects their decision to adopt technology in their operations. It is also clear that SMEs tend to invest in technology when they become more stable. Notwithstanding the many challenges, SMEs are beginning to adopt technology to experience the enormous benefits it brings (Dhillon *et al.,* 2009). However, the same cannot be said for SMEs in developing countries, where they are faced with unique problems due to the poor existing working conditions (Duncombe & Molla, 2009). Since this study is focusing on SMEs in a developing economy like Ghana, it is imperative to understand how SMEs in developing economies are taking up the adoption of technology.

2.9.1 Adoption of Technology within Small and Medium Enterprises in Developing Economies

Different definitions of technology adoption exist in literature (Sharma & Bhagwat, 2006; Laudon & Laudon, 2009). This is due to the different stages of the adoption process. This study recognizes technology adoption as consisting of three stages (Sharma & Bhagwat, 2006; Laudon & Laudon, 2009):

1. The decision making stage which involves the collection and evaluation of the needed information about a desired technology. The decision to adopt the technology is then taken.

2. The implementation stage is the second stage and involves the installation of components of the technology.

3. The third stage is the evaluation stage and includes the evaluation of the implemented technology solution.

As the benefits of technology become evident, many SMEs in developing economies are starting to adopt and use technology in their operations (Laudon & Laudon, 2009). This adoption process is however faced with several challenges (Macharia, 2009), thereby making the adoption process very slow. This is due to unfavourable working environments in developing countries (Duncombe, 2005).

SMEs in developing economies are faced with the challenge of limited financial resources, leading to the channeling of capital resources to only their core business functions (Agbeibor, 2006; Beck, *et al,* 2003). For such SME operators, the investment in technology is often seen as a secondary venture and as such they do not see the immediate impact of such systems on their business (Dhillon, *et al,* 2009) and hence, they give less priority to such investments.

SMEs are often presented with different adoption paths to choose from in their attempt to adopt technology in their operations. These different paths can be categorized as follows (Turban & Volonino, 2010; Laudon & Laudon, 2009):

1. *Internal development:* This is when SMEs decide to design and develop a technology solution from the beginning using internal resources;

2. *External development:* Involves SMEs employing the services of software development firms to develop technology solutions;

3. *Commercial-Off-The-Shelf (COTS) Solutions:* Here, SMEs can choose to go for COTS with or without modifications from the software developer. SMEs can also choose to make their own modifications with the help of internal expertise.

4. *Application Service Provider:* It involves the outsourcing of computing services from a service provider through the Internet or a private network. A typical example is cloud computing technology, or;

5. SMEs can choose to use a combination of the above paths.

The limited resources, harsh business working environment and other challenging conditions affect the decision by SMEs in developing economies to invest in technology (Kapurubandara, 2008). Most of these SMEs lack the technical know-how to develop their own technology solutions (Ayyagari, *et al,* 2007), leading to their reliance on COTS solutions, which are considered more affordable and readily available (Dhillon, *et al,* 2009). COTS solutions are popular and widely accepted by many businesses (Laudon & Laudon, 2009; Dhillon, *et al,* 2009). This however, does not present a convincing assurance on the reliability of such solutions to SME operators.

The adoption and use of a new technology is considered a transition full of risks and uncertainties (Caruso & Marchiori, 2003), and this comes with new issues which when added to the existing problems, increases the complexity of managing firms (Megginson, *et al,* 2008). The lack of human and capital resources, coupled with a harsh business environment (Agbeibor, 2006; Kapurubandara, 2008), leads to a situation where SMEs are not able to implement technology solutions to the fullest (Tyler & Shah, 2006; Caruso & Marchiori, 2003).

Studies have shown that the main factors that affect the decision to adopt and use technology among SMEs in developing economies include cost, lack of expertise, poor infrastructure, governmental policies, and the belief that technology adoption will not reduce cost and lead to positive gains (Duncombe & Molla, 2009). Additionally, social context and organisational challenges can be obstacles to the successful adoption of technology within SMEs (Higgo, 2003). The next section discusses the state of technology adoption in Ghanaian SMEs.

2.9.2 Adoption of Technology within Small and Medium-sized Enterprises in Ghana

According to Lai, Zhao and Wang (2006) information technology has the potential to enhance operational efficiency and effectiveness, change the nature of competition among businesses in order to create strategic opportunity and redraw competitive boundaries. ICT is regarded as a new competitive instrument, needed for the development of a sustainable competitive advantage to enhance the competitiveness of SMEs in terms of productivity and flexibility (Byrd &Turner, 2001; Jin, 2007).

The competitive business environment currently being experienced globally makes the adoption and use of ICT inevitable to Ghanaian SMEs if they are to survive. Despite the growing awareness of the positive impact of Internet technology, little attention has been paid by SMEs in Ghana towards the adoption of Internet technology. In the present competitive and dynamic business environment, SMEs need to adopt innovative technologies to remain distinct, profitable and succeed in domestic, regional and international markets. The impact of on-line technologies has been uneven with just a few individuals and firms taking advantage of these new technologies (United Nations Conference on Trade and Development, 2004).

In Ghana, SMEs account for about 90% of registered firms, 70% of GDP and about 80% of employment (Ahiawodzi & Adade, 2012). There is therefore the need to develop systems and innovations that can assist SMEs to be efficient and productive (Yeboah-Boateng & Essandoh, 2014). According to International Telecommunication Union (2010) the Internet usage in Ghana between the periods 2000, 2006, 2008 and 2009 were 30,000, 401,300, 880,000 and 997,000 respectively, averaging 4.2% of total population in 2009. Yeboah-Boateng and Essandoh (2014) stated that there is a slow response to information and communication technology adoption by 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 (Boah-Mensah, 2008). 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 (Hinson & Sorenson, 2007). 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 Yeboah-

Boateng and Essandoh (2014) 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 (MOTI, 2011), and the frequent power outages negatively affect SMEs in their adoption of ICT (Asare, Gopolang & Mogotlhwane, 2012).

It can be noted that, because of the lack of technical expertise in developing economies like Ghana (Agbeibor, 2006; Duncombe & Molla, 2009), most SMEs are not able to develop their own technology solutions to address their unique needs. They therefore resort to COTS. Most of these COTS are however designed and developed in developed economies (Stair & Reynolds, 2008), considering the needs of their firms. With SMEs in developing economies operating under different conditions (Todaro & Smith, 2006), such technology solutions usually do not meet the unique needs of these SMEs.

The adoption of technology is a major competitive tool that will help SMEs in Ghana to survive and achieve the needed competitive advantage (European Commission, 2002). The next section discusses SMEs and how their adoption of technology can help them achieve competitive advantage.

2.10 Technology Adoption for Competitive Advantage of Small and Medium Enterprises

Compared to their larger counterparts, the adoption of technology by SMEs is relatively difficult as they tend to outsource most of their technology needs. The adoption of technology brings about competitiveness and allows businesses to enter new markets with new opportunities. Organizations that have in-house technology solutions therefore stand to gain more. However, according to Thurasamy, Ramayah, Mohamad, Omar, and Marimuthu (2009) the limited human resources available to SMEs makes it difficult to have personnel with the requisite skills to manage the technology.

Amongst others, technology helps in value creation, problem solving (Melville et al, 2006) as well as for communication. The fact that technology usage enhances efficiency makes it an important competitive enabler (Valacich & Schneider, 2010). When an appropriate technology is adopted, a business organization can achieve higher competency, experience improvements in its performance as well as ensure that its competitive advantage is retained.

Competitive advantage comes as a result a firm’s ability to develop products whose value exceeds the cost of producing that product (Moghavvemi, *et al.,* 2012). According to Porter (2000) the numerous activities that occur in the creation, production, selling, and delivery of a product or service are the basic units of competitive advantage. To maintain a sustained competitive advantage, there is the need for firms to adopt a strategic approach through the creation of a unique and valuable position, involving a different set of activities. Thus, technology is seen as an important resource for the attainment of competitive advantage. As a result, technology is best accepted when it is seen to support the organization's strategy towards attaining or sustaining competitive advantage against competitors (Valacich & Schneider, 2010).

With the increasing level of competition and usage of technology in businesses, the adoption of technology by businesses is a strategic necessity. Additionally, the use of technology impacts positively on the performance of businesses in several ways: through profitability, market share, value added products and services, reduced operational expenditure, and better coordination of activities among organizations (Khong, Sing, Binshan & Uchenna, 2010). According to Chong, White and Prybutok (2001) the close relationship between firms and their customers and the efficiency of the operations are all a result of the use of technology, thus allowing SMEs to compete globally.

2.11 The Role of Cloud Computing in Competitive Advantage in Small and Medium-sized Enterprises

The idea of using cloud computing in SMEs is not only a sign of improvement in technological data centers, but also signifies the change in how IT services are provisioned and delivered to users from one place (Sultan, 2011). SMEs by their nature operate with minimal resources. Therefore there is the need for them to adopt a strategy that allows them to effectively upgrade their IT infrastructure in order to meet changing business requirements effectively. Their ability to implement modern technologies in their operations increases their ability to participate in highly advanced business environments and to contend with prevailing competitors.

Cloud computing is highly beneficial for large organizations but SMEs are gradually adopting and using its benefits to attain the needed competitive advantage. Organizations are offered benefits through cloud computing as they implement such services (Adam & Musah, 2015). The adoption of cloud computing brings about cost cutting. This is particularly important for SMEs and large organisations alike as it helps in maintaining operations and capital expenses at a minimal amount. In addition, it helps in saving substantial costs on application and zero in-house server storage (Gupta, Seetharaman & Raj, 2013). SMEs also reduce their operational cost due to the off-premises nature of cloud computing which reduces the impact of administration, air conditioning, and power costs (Zhang, Cheng, Boutaba, 2010).

Cloud computing is highly scalable. SMEs are as a result able to get quick resource allocation in a controlled environment, free of overloading due to proper management of systems (Conway, Curry & Donnellan, 2014). Cloud computing services are highly reliable due to the managed services by the service provider. Cloud computing services are offered 24/7/365 and can easily be transmitted to further available servers in case of failure of application (Gupta et al. 2013).

Cloud computing can easily be managed as it is not required to install on every computer and can thus be accessed from multiple locations. Cloud computing allows for the customization of tailor made solutions. Cloud computing is web based and therefore services can easily be accessed with an Internet connection and thus the need for software and hardware is reduced.

SMEs need less licensed software (Lawton, 2008), and thus, they can grow without investing large sums of money on software. Through innovation in cloud computing, firms can interact with customers, employees, and partners. Firms can get highly credible business opportunities which can help them to build real-time interaction and innovation to flourish their enterprise (Alshamaila, Papagiannidis, Li, 2013). It must be stated that competitiveness of an SME depends on the ways in which cloud computing service is used to support business processes. Therefore adopting cloud computing in a business does not necessarily give any competitive advantage, but having it linked to the business process and strategy will most likely lead to a competitive advantage.

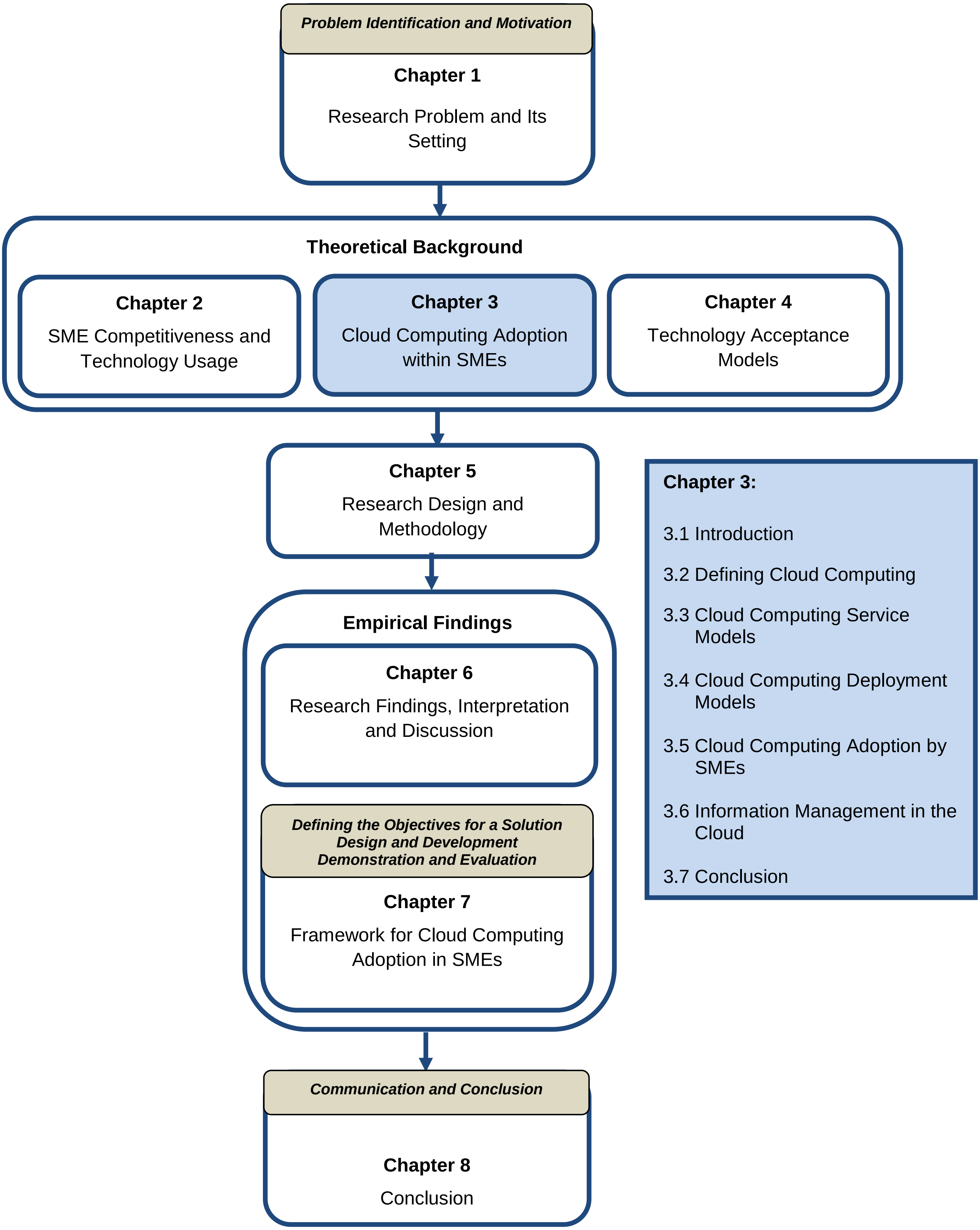
2.12 Conclusion

This chapter presented the definition of SMEs and their economic role. There was then a discussion on the literature regarding the characteristics and challenges that face SMEs as well as the business environment within which SMEs carryout their operations. This chapter also reviewed some of the theories behind SME competitiveness. To continue to exist and operate as a business, SMEs need to be competitive. They must therefore adopt different business strategies that will help them attain the needed competitive advantage. Some of the strategies were therefore reviewed in this chapter and this was followed by a discussion of the relevance of technology in SME development.

The success or otherwise of any business depends on the availability of capital and the business environment. However, in developing countries, there is a lack of these critical factors and this results in the failure of businesses (Agbeibor, 2006). Additionally, SMEs operating in developing countries do so under difficult business conditions, and are illprepared to face these challenges. Strengthening the competitiveness of these SMEs will undoubtedly boost the socio-economic growth of developing economies.

The unfavourable business environment in developing countries does not allow SMEs to fully realize their potential. For developing countries trying to improve their economy, it is important to put measures in place to support SMEs. Identifying the challenges SMEs face is the first step to finding such solutions.

One important way to translate the enormous opportunities presented by SMEs is the incorporation of technology as a business strategy to harness the opportunities it offers. Technology has the potential to improve performance and business competitiveness and according to Martin-de Castro, Delgado-Verde, Navas-López and Cruz-González (2013) developing a successful technological innovation is key to creating and sustaining a firm's competitive advantage. Since SMEs normally outsource their technological needs in order to concentrate on their core business function, the adoption of cloud computing as an alternative makes a compelling business case for SMEs. This chapter is relevant to the research problem as it provides an overview of SMEs and the strategies they need to adopt to improve their competitiveness. It became evident that the adoption of technology solutions, particularly cloud computing, can improve competitiveness. The next chapter (Chapter 3) focuses on cloud computing adoption and the implications for business.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Chapter 3: Cloud Computing Adoption within SMEs

3.1 Introduction

The previous chapter discussed small and medium-sized enterprises and strategies they can adopt to be competitive. According to Charoen (2012) information and communication technology is the main index for measuring a country's competitiveness. There is therefore an urgent need to introduce a technology that can offer a fundamental contribution to allow for growth and competition and also help the economies of nations to recover from the present downturn. This new technology, cloud computing, is a frontier of the Internet era, and it allows businesses to store information on servers and it is provided online as a service to clients in a pay-as-you-go manner.

The concept behind cloud computing is that information technology (IT) services such as hardware, software and other technology applications are rented out to businesses and payment made for the amount of time the service is used or stored. Though in its early days, cloud computing has become a top technology priority for businesses to achieve competitiveness (Carcary, Doherty & Conway, 2014). It promotes availability and allows businesses to outsource their IT needs and thereby frees them from building and maintaining IT infrastructure so they can focus on value-creating differentiation to run over that infrastructure.

When this technology is adopted, firms will be able to avoid large up-front costs and spend in information and communication technology (ICT) according to their production necessities. This has the potential of impacting on the cost structure of all firms, especially small and medium-sized enterprises (SMEs). However, despite its numerous benefits, there are some undiscovered facts and concerns that exist and need to be investigated to help build a good business case for cloud computing globally (Carr, 2008).

This chapter is relevant to the study in that it aims to achieve a better understanding of cloud computing technology and its adoption, and the related business implications. The general introduction is followed by a review of the concept of cloud computing and in particular, the various types of cloud computing deployment and service delivery models will be explored. The chapter then reviews literature on cloud computing adoption by SMEs. Cloud adoption drivers as well as concerns will also be discussed. The chapter then continues with the review of technology adoption strategies aimed at helping SMEs reach a competitive advantage, information management and data management activities in a cloud environment, and finally a conclusion of the chapter.

3.2 Defining Cloud Computing

Cloud computing is currently a topical issue. However, there seems to be no consensus when it comes to the definition of cloud computing. There is not a universally accepted definition of cloud computing (Vaquero, Rodero-Merino, Caceres & Lindner, 2009; Grossman, 2009). Different definitions have been proposed by different authors (Armbrust, Fox, Griffith, Joseph, Katz, Konwinski & Zaharia, 2010; Marston, Bandyopadhyay, Zhang & Ghalsasi, 2011) and organizations such as Cloud Security Alliance (2011) and National Institute of Standards and Technology (2011).

According to Ragent and Leach (2010) cloud computing is an Internet-based technology that allows for convenient, on-demand network access to shared resources, software and information which is made available on computers and other devices. This is a new business technology paradigm that enables sharing of technological resources and business process-like services over the Internet. Thus, this paradigm of computing provides an entirely new computing model as it converts a fixed-cost structure to a transactional pay-as-you-go fee-based service. In cloud computing, computing resources reside on the network servers of the service provider and are provided to users (customers) as a service online, either by subscription or on a pay-as-you use basis.

LuitBiz (2010) define cloud computing as a type of computing whereby virtually shared servers make available resources such as software, infrastructure, platform devices and hosting to users (customers) on a pay-as-you-go basis via the Internet. Customers can then access these cloud computing resources (LuitBiz, 2010). This means businesses can now outsource the IT needs and focus on their main business process. Additionally, there will be no need for individual users to purchase individual programs as these will be provided by cloud service providers.

Kramer (2012) sees cloud computing as a new computing paradigm. It changes the procurement, maintenance and disposal process of information technology. Large investments in fully-owned IT-assets are substituted by on-demand procurement of a dynamic basket of information technology resources. These resources are hosted in specialized data centers. Cloud computing can be purchased and scaled just over the Internet, on-demand and location independently. Direct data control is substituted by service contracts that specify availability, data-loss prevention, liability, flexibility and pricing. NIST on the other hand, 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 (NIST, 2011).

In his definition, Kramer (2012) put into perspective the business aspect of cloud computing by focusing on the economic and strategic aspects of cloud computing to make it more attractive to SMEs. On the other hand, NIST (2011) came out with a technical definition of cloud computing. It offered an in-depth understanding on the subject of cloud computing from the technical perspective and put forward five essential characteristics, three service models and four deployment models.

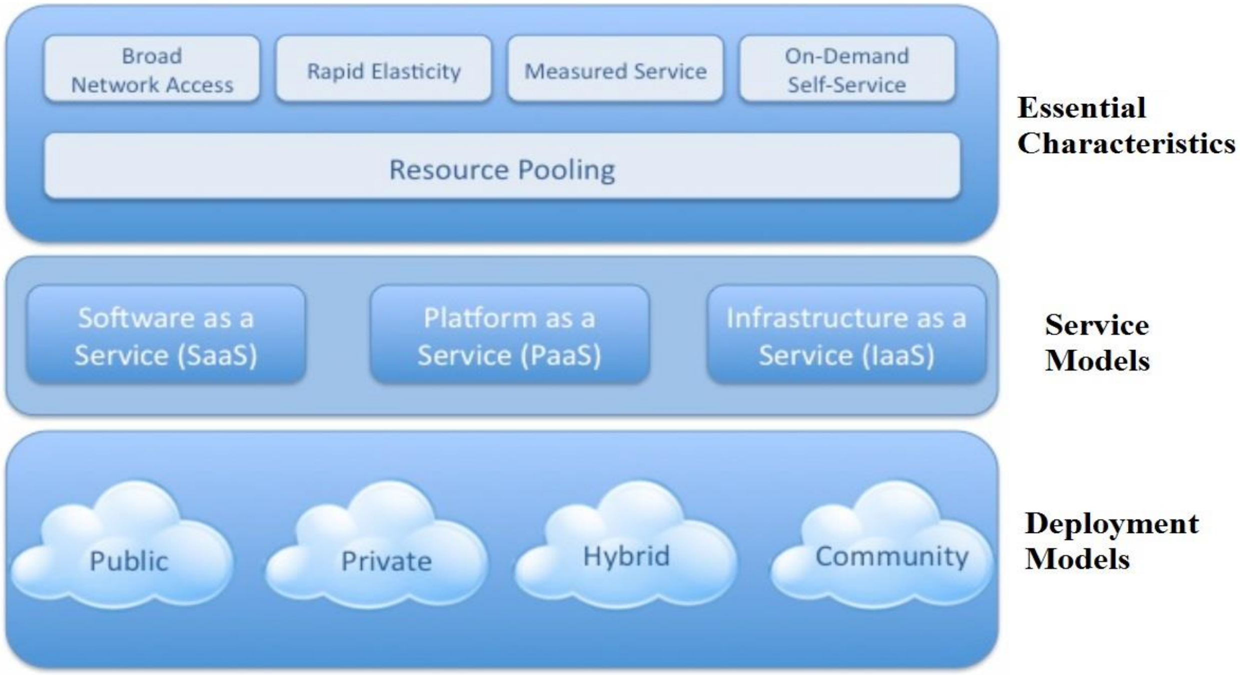


Figure 3.1: NIST Visual Model of Cloud Computing Definition (Cloud Security Alliance, 2011)

Cloud computing service providers offer a broad range of software services. These services include development tools that allow the development of scalable applications upon their services. The bottom line is a system that allows customers to run their daily IT infrastructure in “the cloud”.

For businesses, the mere fact that users get access to computing resources means that the cloud supports their development. This is can be achieved through virtual technology, i.e., cloud computing, that uses the resources of servers located far and near to bring together operating systems and applications in a single computer.

Cloud computing resources may either be in the form of applications, services or infrastructure. Depending on their needs, users can access these applications, infrastructure or services through the Internet on a pay-as-you-use basis. This help businesses to avoid the cost of purchasing software and hardware. Figure 3.2 shows how users can also host their data on a platform that is rented out by the cloud service provider. Users can then access their data through their personal servers. Also, users can host their data and other applications online in a secure environment (the cloud) and accessed via the Internet by multiple users in different locations. Users make use of several computing devices such as desktops, laptops, phones or tablets to access applications made available by a service provider. Moreover, users can subscribe to use an infrastructure from the cloud for computing or storing of data and information.

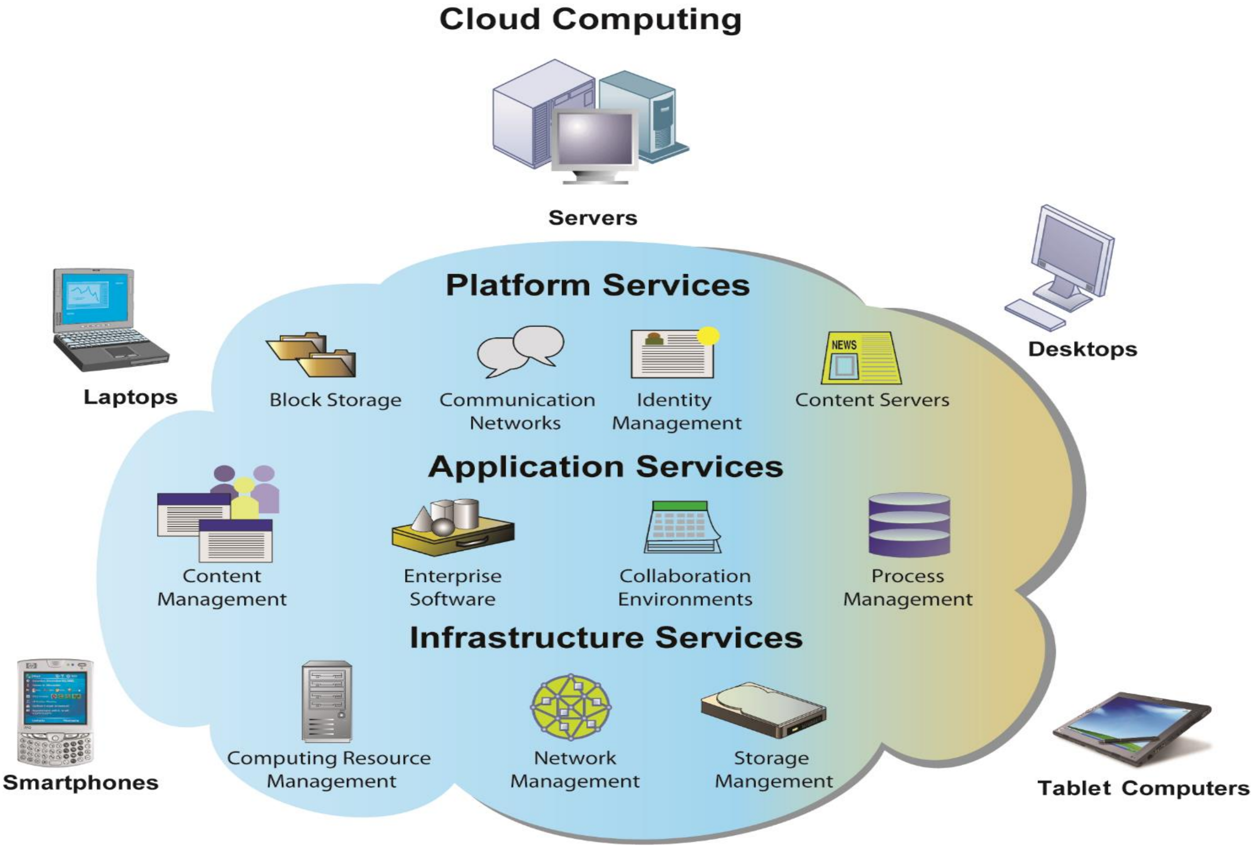


Figure 3.2: Cloud Computing (Source: Laudon & Laudon, 2012)

Thus, cloud computing allows users to access applications that exist in a secure location away from the user's computer or other Internet-connected device (Velte, et al., 2010). Additionally, LuitBiz (2010) emphasizes that cloud computing users normally rent the cloud resources from a third party, the cloud service provider. This means users pay for the services they use.

As mentioned earlier, the NIST (2011) definition gives a technical perspective of cloud computing and puts forward three service models and four deployment models. These are discussed in the next three sections.

3.3 Cloud Computing Service Models

Cloud computing services models describe the various types of services that can be obtained from the cloud. Their categorization is based on the level of abstraction and the resources they provide. According to Buyya, Broberg and Goscinski (2011) three different categories of cloud computing service models can be identified, namely: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). These cloud service model are explained in subsections that follow.

3.3.1 Software as a Service (SaaS)

Applications serve as the highest level of the cloud architecture model and are the most familiar. In this service model, the application is owned and hosted by the service provider, who rents it out to the user and it is accessed through the Internet (Shimba 2010). The applications are then used on the user's local computer through web portals. The applications are pre-made, and any vital software, operating systems, hardware and network are provided in this service model. Hence, end users move from buying and installing application packs to online software service with the same functionality. Traditional desktop applications such as spreadsheets and access databases can be accessed as a service. A similar type of service, Google's Gmail, is a popular and widely used SaaS platform. Thus, end users can sign up for needed software which is available on the Internet and can be accessed using an Internet browser.

There is no need for the user to be concerned about the infrastructure and/or the platform where they run their applications (Creeger 2009; Durkee 2010). The entire infrastructure is situated in datacenters and managed by the service provider. This model of providing applications, known as SaaS eliminates the burden of users having to run testing, upgrades and maintenance of software (Youseff, Butrico & Da Silva, 2008). According to Lin, Zhu and Dasmalchi (2009) this model targets IT users. The increased adoption rate of SaaS in corporate IT is due to the fact that SaaS platforms provide all the complex software packages while mitigating the challenges that are associated with legacy software environments. Users of SaaS applications can however make changes to the settings (Muriithi & Kotzé, 2012). Examples of SaaS applications include: Dropbox, Facebook, Microsoft Office 365 and Customer Relationship Management (CRM) application, Twitter, Hotmail and Google Apps. Most of these personal applications are free online services (Muriithi & Kotzé, 2012).

3.3.2 Platform as a Service (PaaS)

The next level of service is the PaaS which is similar to SaaS. The service provider makes available infrastructure with platforms containing programming tools for users on a rental basis to develop their own applications. However, the difference between SaaS and PaaS is that whiles SaaS gives users little room for modifications, PaaS gives users room for maintaining the application on their own terms (Cloud Security Alliance, 2009). It offers not only infrastructure, but also operating systems and software development tool kits. It offers a level of abstraction to make a cloud easily programmable. The end-user installs or develops their own software and applications. That is, it provides an environment for development and is hosted on third-party infrastructure to facilitate rapid design, testing, and deployment of new applications.

This model particularly targets developers (Lin *et al.,* 2009). The cost of consuming resources in this environment is greatly reduced. Therefore, this level allows new programmes required by cloud computing, tests them in a cloud environment and eventually offers them to cloud computing users. Additionally, multiple programming models and specialized services (such as, data access, authentication and payments) are offered as building blocks to new applications (Appistry, 2009). Google App Engine, VMware's Springsource and Amazon Web Services are common examples of PaaS. PaaS provides some level of control over the developed applications even though it comes with its own security concerns as users do not own the computing infrastructure

3.3.3 Infrastructure as a Service (IaaS)

IaaS is the lowest level of the architecture of cloud computing systems (Buyya, Yeo, Venugopal & Brandic*,* 2009) and is responsible for infrastructure. It can almost be viewed as a reverse of SaaS. With this service model, the service provider supplies the required hardware resources (central processing unit capacity, memory volume, servers, data storage, management controls, 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 (Mitchell 2008). Additionally, the user has the freedom to use any operating system and software of their choice. The user can install or develops their own operating systems, software and applications. The IaaS service model allows users to take advantage of scalable networks and data centers at a fraction of the cost compared to building their own infrastructure. Users are given the rights to manipulate the server to meet their requirements (Buyya *et al.,* 2011). Thus, the user is given the right to applications on their own terms, maintains the storage and deploys the network they want by hosting firewalls (Mell & Grance 2009). Even though the model offers some level of control over the deployed applications and operating, storage and selected network components, the user according to Mell and Grance (2011) does not have control over the infrastructure. Web Services for instance offer IaaS to customers. According to Lin *et al.* (2009) this service model targets mainly the infrastructure providers and system administrators. Examples of IaaS are Amazon Elastic Compute Cloud (EC2), Simple

Storage Service (S3) and Simple DB. Figure 3.3 gives a representation of the three main models of cloud computing services and their consumer types.

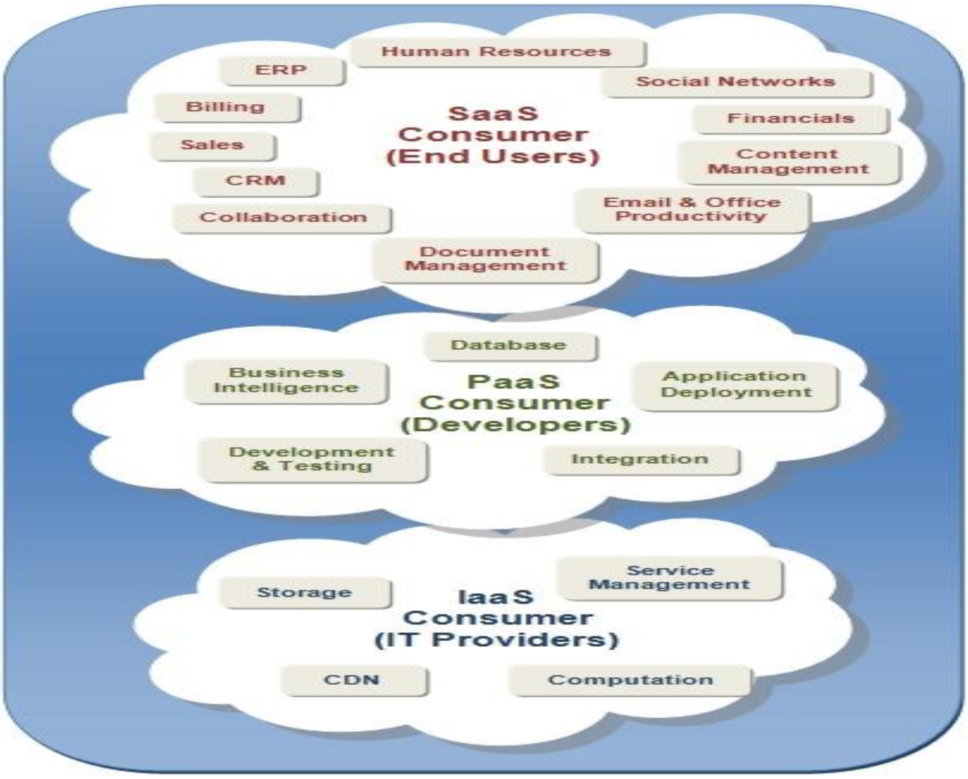


Figure 3.3: Cloud computing services and their consumer types (Source: InfoCloud, 2015)

3.3.4 Service Model Relevant To This Study

Service models are used to describe the different types of services that cloud computing has to offer to end users. This study seeks to identify how cloud computing can be adopted by SMEs as a competitive tool. There is therefore the need for a service model that meets the technology needs of businesses and is appealing to the end user so that it is adopted as a business strategy. From the description above of the different types of cloud computing services, it is evident that they are all end-user computing of some sort. Therefore, since the study is not considering any particular type of user but the adoption of the technology for SMEs to be more competitive, the use of any of the service models will be applicable to the study.

3.4 Cloud Computing Deployment Models

Even though the existence of cloud computing is as a result of the spread of public computing utilities, other deployment models and different geographical location distribution models have been adopted. In this regard and without considering its service class, a cloud can be classified as public, private, community or hybrid (Mell & Grance, 2009). The sections below provide a more detailed description of the types of deployment models.

3.4.1 Public/External Cloud

According to Armbrust *et al*. (2010) public cloud is the type of deployment model that makes resources available in a pay-as-you-go manner to the general public. Services are offered over the Internet and are owned and operated by a cloud service provider (Zhang, Cheng & Boutaba, 2010). Users are untrusted and the cloud service provider normally has no contractual agreement with the users. Because of its multitenancy nature, this deployment model is often regarded as a cloud, and is made available to the general public over the Internet for open use.

Public cloud is also known as external cloud as a result of the availability of infrastructure to the general public through web browsers (Johnson, 2009). This cloud delivery model offers cost-efficiency, flexibility, resilience and easy management of cloud computing resources (Bhat, Shah & Ahmad, 2011). Payment for the used resource is usually done on a monthly basis, thus, it is inexpensive for users to employ the public cloud because it offers a flexible, cost effective means to deploy solutions (Ahronovitz, Amrhein, Anderson, Arasan, Bartlett & Bruklis, 2010).

Public cloud provides services targeted at the general public such as online data storage services like Dropbox (Mell & Grance, 2009), e-mail services or social networking sites and are often offered for free. Services for enterprises and government organizations can also be provided in a public cloud. However, some public cloud services are not free and may come with a payable option. Also, according to Ahronovitz, *et al.,* (2010) being public does not necessarily mean user's data is made publicly available to other users but rather public cloud service providers give access and security mechanisms for their different users. Public cloud computing however does raise some security concerns that can affect the decision to adopt a cloud service. According to Almunawar, Kang and Susanto (2012) the public cloud is susceptible to attacks (security threats) and easy access. Also because public cloud computing is open to the general public for easy accessibility, Ragent and Leach (2010) noted concerns regarding security, privacy and service reliability. Amazon, Apple, Microsoft and Google, are some examples of vendors that offer public cloud services and figure 3.4 shows an example of public cloud whereby a user is able to access database and storage services through the use of the Internet.

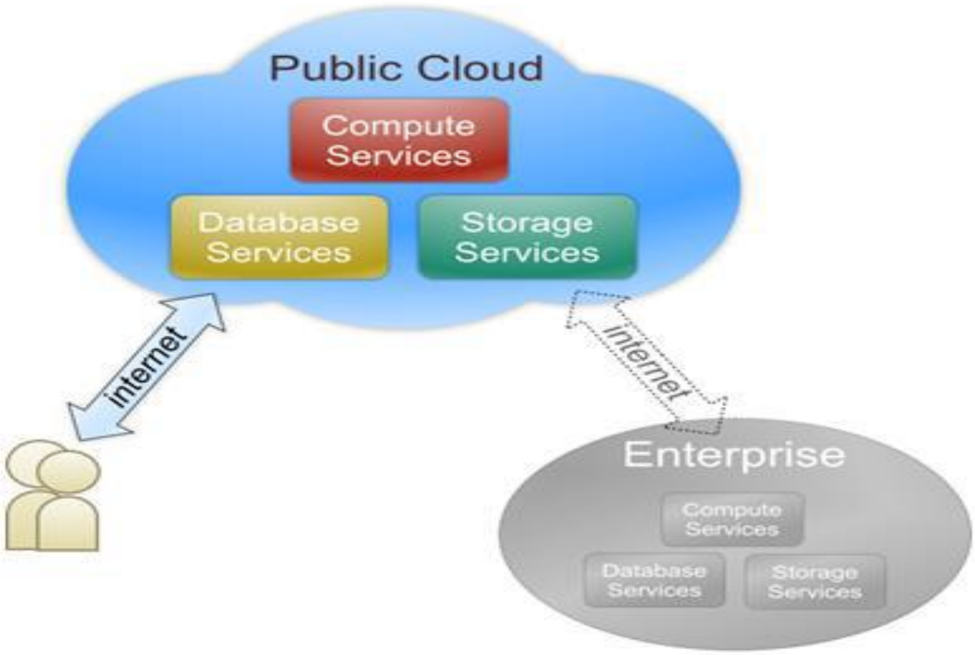


Figure 3.4: Public Cloud (Ahronovitz, Amrhein, Anderson, Arasan, Bartlett and Bruklis, 2010)

3.4.2 Private/Internal Cloud

Private cloud is the type of deployment model where an organisation build an internal data center to run cloud service and is not made available to the general public (Armbrust *et al.,* 2010). It is often referred to as internal or personal clouds and is designed, built and managed by and for a single organization (Zhang *et al.* 2010). This organisation may be made up of several business units (Mell & Grance, 2011).

The physical infrastructure may be owned by and/or located in the organization's datacentres (on-premises) or a third party (off-premises) with some aspects of management and security controls taken care of by the organization or the service provider (third party) respectively (Bardin, Callas, Chaput, Fusco & Gilbert, 2009). This depends on the service agreement between the two parties. Thus, private cloud computing applications are perceived to be more secure than public cloud computing applications and users are considered as trusted.

However, an organization implementing their own private cloud on their premises may not yield the expected financial benefits as compared to the highly scalable private cloud developed by a service provider. Private clouds are normally without network bandwidth constraints, security exposure and legal requirements (Bhat *et al.,* 2011) and have high level of control over access with the ability to host and customize services to organization requirements (Almunawar, *et al.,* 2012).

The private cloud could be an intranet or email system that only users within the organization can use and have access to (Mell & Grance 2009) and therefore requires a reliable Internet connection and standard browser to access and effectively utilize private cloud computing applications (Boss, Malladi, Quan, Legregni & Hall, 2007). Figure 3.5 illustrates the schematic of an organization’s on-premises private cloud and which is managed by the organization. In this particular instance, limited access is provided to the external users behind the organization’s firewall but internal users have unlimited access to resources of the private cloud and are able to set their own security checks to restrict unauthorized users.

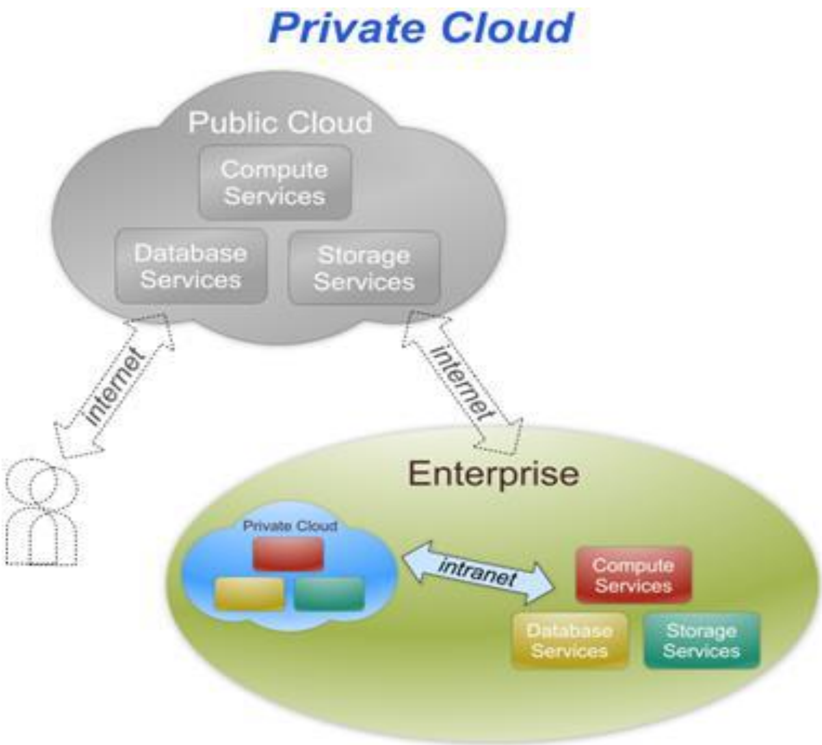


Figure 3.5: Private Cloud (Ahronovitz, Amrhein, Anderson, Arasan, Bartlett and Bruklis, 2010)

3.4.3 Community Cloud

In community cloud, resources are shared by organizations, users or a specific community who share similar concerns such as a mission, security requirements, policy and compliance considerations (Mell & Grance, 2009; Marston *et al.,* 2011). It is also known as an external cloud. The shared infrastructure could be managed and hosted internally or externally by a cloud service provider or some combination of them, and may exist on or off the premises of the organization depending on the service agreement (Shimba, 2010). The involvement of a third party member depends on the service model that is in place. A community cloud is very common amongst governmental organizations, educational campuses and healthcare centers that operate under a shared goal and also relies on shared data. Thus, community cloud is a good alternative when forming partnerships (Mell & Grance, 2009).

A community cloud is relatively expensive to operate compared to its external counterpart (public cloud). This is as result of the fact that, in community cloud, the operational expenses are spread over fewer users. It must be noted however that community cloud offers a better level of privacy, security and compliance (Baize, 2011). Users are considered as trusted. Figure 3.6 shows a diagram of a typical community cloud. It indicates several users of a particular community accessing resources in that particular cloud.

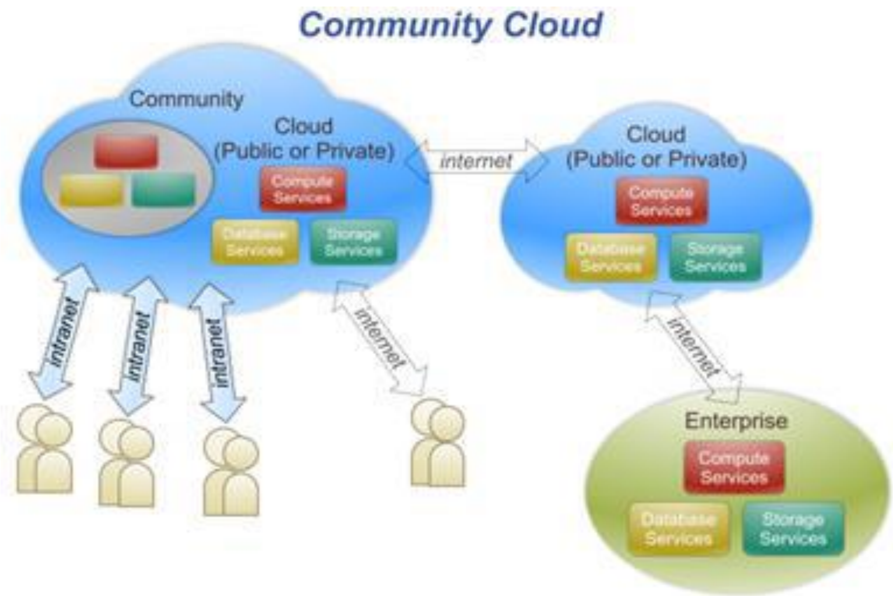


Figure 13.6: Community Cloud (Ahronovitz, Amrhein, Anderson, Arasan, Bartlett and Bruklis, 2010)

3.4.4 Hybrid Cloud

Hybrid cloud is a combination of two or more of the other deployment models (private, community or public) which are bundled together but each operating separately (Mell & Grance, 2011). The hybrid cloud tries to fix lapses in each of the deployment models used in the combination (Zhang *et al.,* 2010). This cloud deployment model is commonly used by organizations who put their critical data in a private cloud but store their non-critical information in a public cloud (Bhat et al., 2011). Hybrid cloud solutions are in ideal organizations where strong requirements for security or regulatory compliance exist together with requirements for price and performance. According to Mell and Grance, (2009) a typical example of hybrid cloud can be seen in organizations where all employees are put on a public cloud but their critical data is placed in the private cloud and is only accessible by the managers. Figure 3.7 illustrates a typical hybrid cloud, where the service provider takes charge of the resources based on the user's terms, and with the user having no idea as to what the provider actually does in the cloud (Ahronovitz, *et al.,* 2010). In this type of cloud, only organizations using the infrastructure have access to the resources (Shimba, 2010).

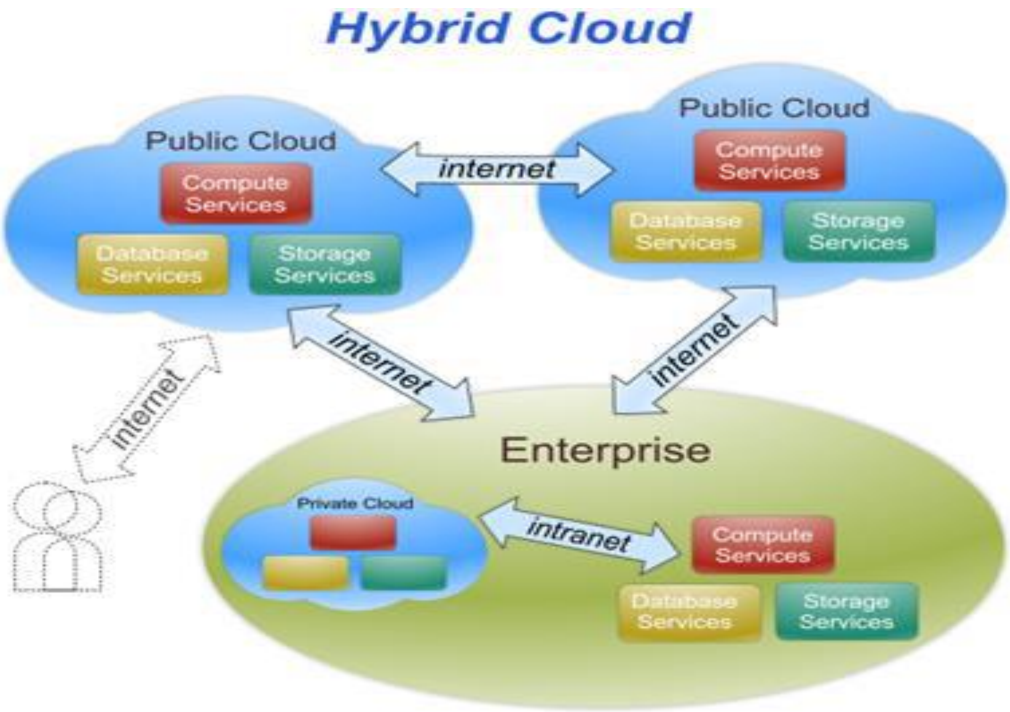


Figure 3.7: Hybrid Cloud (Ahronovitz, Amrhein, Anderson, Arasan, Bartlett and Bruklis, 2010)

3.4.5 Cloud Computing Delivery Model Relevant To This Study

From the four cloud computing delivery models reviewed, it can be deduced that the classification is based on some key characteristics, namely:

1. Who owns the cloud infrastructure?
2. Who manages the cloud infrastructure?
3. The location of the infrastructure? and
4. Who has access to the cloud services?

Figure 3.8 summarizes these characteristics of cloud computing delivery models:

	Infrastructure Managed By[1]	Infrastructure Owned By[2]	Infrastructure Located[3]	Accessible and Consumed By[4]
Public	Third Party Provider	Third Party Provider	Off-Premise	Untrusted
Private/ Community	Organization Or Third Party Provider	Organization / Third Party Provider	On-Premise / Off-Premise	Trusted
Hybrid	Both Organization & Third Party Provider	Both Organization & Third Party Provider	Both On-Premise & Off-Premise	Trusted & Untrusted

[1] Management includes: governance, operations, security, compliance, etc...
[2] Infrastructure implies physical infrastructure such as facilities, compute, network & storage equipment
[3] Infrastructure Location is both physical and relative to an Organization's management umbrella and speaks to ownership versus control
[4] Trusted consumers of service are those who are considered part of an organization's legal/contractual/ policy umbrella including employees, contractors, & business partners. Untrusted consumers are those that may be authorized to consume some/all services but are not logical extensions of the organization.

Figure 3.8: Cloud Deployment Models and their Characteristics (Source: Bardin et al., 2009)

The abovementioned cloud computing delivery models are relevant to users from different backgrounds. However, for the purpose of the current study, public, private and community clouds will be considered. The reason is that these three cloud models offer direct access to resources for end-users. However, in the case of hybrid cloud, end-users (general public) do not have access to resources but rather the organization (Shimba, 2010).

3.5 Cloud Computing Adoption by Small and Medium-sized Enterprises

Adoption is replacing something old with something new and making it your own to serve your needs. According to Jaakkola (1996) replacing traditional IT solutions with new and more advanced ones to achieve the same business goal is referred to as technology adoption. Cloud computing adoption is therefore moving from a point of not using cloud technology to a stage where an organization makes it part of their business strategy. The above description of adoption will therefore be applied throughout this study.

Technology is created by different people for different purposes (Bridges to Technology Corp, 2005) and therefore their adoption by users, and for that matter organizations, occurs under different circumstances. Whereas SMEs tend to outsource most of their technology with the aim to be competitive and facilitating expansion to new markets; big organizations gain more by having in-house solutions and adopting most of their technology in-house. Due to SMEs' limited manpower compared to their bigger counterparts, it is difficult to have dedicated personnel to manage the IT infrastructure (Thurasamy *et al.,* 2009). SMEs are therefore left with no choice but to outsource their IT needs in order to concentrate on their core business operations (Bose & Sugumaran, 2006; Vijeikis & Makstutis, 2009). This makes cloud computing an alternative for SMEs.

3.5.1 The Role of Cloud Computing for Enhancing Competiveness

The proper utilization of advanced ICTs as a tool can improve business competitiveness. The benefits from the use of ICTs can make SMEs compete in their market with larger organizations (Ahson & Ilyas, 2010). Issues associated with the management of hardware, software and networking in traditional IT environments are on the increase. It is therefore expected that SMEs engage the services of IT specialists to implement and maintain their IT infrastructure.

Cloud computing serves as an alternative for SMEs and offers an appropriate solution for these IT issues by providing scalable capabilities and infrastructure to SMEs (Sharma, Mehra, Jola, Kumar, Misra & Tiwari, 2010). According to Vouk (2008) cloud computing presents immediate access to IT solutions and thereby allows SMEs to expand their services through the enhancement of customer interaction and market reach. The use of cloud computing by SMEs helps to maximize their return on investment and helps them to operate in a demanding corporate environment effectively (Velte, Velte & Elsenpeter, 2009). The use of cloud computing by SMEs does not only serve to promote improvement in technological data centers, but also indicates a fundamental change in how IT services are used, provisioned and delivered to end users (Sultan 2011). SMEs by their nature operate with limited human and financial resources. This reduces their ability to effectively upgrade their IT systems so as to meet changing business requirements. Their inability to adopt modern technologies also reduces their chances to operate in highly advance business environments and compete with existing competitors (Sharma et al. 2010).

However, the adoption of cloud computing offers enterprises a wide range of possibilities such as provision of storage devices, IT infrastructure, distance consulting, continuous training, and specifically private cloud infrastructure. This means SMEs operating with a small IT department can rent IT services rather than buying from the limited resources available to them. Literature shows that SMEs are motivated to use cloud computing services through the Internet to improve their business capabilities (Alshamaila, Papagiannidis & Li, 2013). However, Zhang et al. (2010) noted that even though cloud computing offers an attractive and compelling option, it comes with unique risks which discourages its adoption. This therefore makes it imperative to appreciate and understand the adoption drivers and risk.

3.5.2 Cloud Computing Adoption Drivers and Benefits

There are different reasons why businesses are driven toward adopting cloud computing. While some adopt cloud computing because of the benefits it affords them, others adopt cloud computing because of the rapid advances in technology and the need to use it. Some of the varied reasons that drive small businesses to actively adopt and use cloud computing services are discussed in the sections that follow.

3.5.2.1 Virtual and On-demand

As the adoption of cloud computing continues to increase, virtualization is a key enabler, driving economies of scale and the ability to scale with IT resources. Virtualization is an important feature of clouds that try to mask the technological complexity from the user and allow enhanced flexibility. Virtual systems offer elasticity and scalability for changing traffic volumes. Through the concept of virtualization, the service provider is able to make stored resources available to multiple users at different locations (Mell & Grance, 2009). This helps to provide a cost-effective on-demand service and thereby reduces capital expenditure.

The on-demand aspect of cloud computing allows users to use computing capabilities as and when they require the resource without the need for human intervention from the cloud provider. There is therefore no need for users to worry about commissioning or decommissioning computing infrastructure as per utilization or requirements (KPMG, 2011). This benefit helps businesses to quickly source computing resources at any time and at any place.

3.5.2.2 Pay-as-you-go

Cloud computing acts like a service provider offering a service to a customer and the customer decides on the type of service to hire from the service provider. The cloud model can be envisaged as utility-like, where businesses pay only for the amount of utility they use in a specified period of time, receive automatic upgrades and can scale up or down easily. This means businesses pay only for the resources they need and the quantity they consume (Carr, 2008). Additionally, Vaquero *et al.,* (2009) state that cloud computing should allow for a more flexible business model where users pay for the resource consumed.

Cloud computing service providers offer the opportunity for end users to only pay for the services they use, and any costs associated with using the service, such as bandwidth. This is considerably different from the traditional licensing model of selling software which has in the past dominated Internet and IT business practice. This pay-as-you-go model for the purchasing of computer services has opened opportunities, particularly for SMEs, to access cloud computing services that were previously only available to larger businesses (Australian Communication and Media Authority (ACMA), 2013).

Instead of businesses buying and installing all their own IT infrastructure and applications, they buy the access to the infrastructure and applications they need as they need them. By so doing, businesses avoid making upfront payment, including more capacity than they may need right away. They only pay for what they use and only as they use it. Businesses usually pay either a flat-rate subscription fee per user or pay-as-you-go usage fees for precisely defined service levels (Ernst & Young, 2011). The pay-as-you-go concept of cloud computing is to help mitigate capital-intensive IT costs, thereby benefiting capital-constrained small businesses (Marston, *et al.,* 2010).

3.5.2.3 Agility, Flexibility and Elasticity

The ever increasing need for higher business agility remains an important driver in the adoption of cloud services. Cloud computing removes the burden of businesses having to build and maintain IT infrastructure so they can concentrate on value-creating platforms to run on that infrastructure. However, even though the interest in cloud computing continues to grow, there is a continual trend of less “cloud vapor” and more focus on “business”. There is therefore the need for infrastructure elasticity to be seen as an enabler for other dimensions that make the business more agile and higher performing (Clair, 2014). The movement to cloud business processes leads to agility and the ability to respond faster to changing business needs. This further leads to a more transformed enterprise.

The supply of cloud computing resources should match the user’s demand. That is, cloud computing should be such that resource availability is instantaneous and on demand. There is often the issue of businesses having to demand IT resources and ending up with more capacity than they actually require or less than they need as a result of business changes during the setting up process. Cloud computing has the ability to elastically scale IT resource requirements either up or down based on the needs of the business. According to Armbrust, Fox, Griffith, Joseph, Katz, Konwinski and Zaharia (2009) end users do not experience any risk of over-provisioning or under-provisioning but the risk is transferred to the service provider.

Cloud providers can resolve this issue by ensuring that the implementation process is aligned closely with business needs and ICT strategies (Ernst & Young, 2011). The elastic nature of cloud computing allows businesses to expand or contract services quickly by tapping into pools of resources or implementing prepackaged capabilities built by service providers specifically for the cloud (Ernst & Young, 2011). This brings about increased flexibility in the form of elastic scalability, allowing businesses to quickly raise or reduce their IT infrastructure costs as quickly as their business needs changes. The cloud makes IT flexible and obtainable from anywhere at any time through the Internet, thereby making it easier to work with (Cloud news desk, 2008).

3.5.2.4 Multi-Tenancy

By leveraging shared infrastructure, cloud computing's multi-tenancy concept offers businesses a compelling business model. When resources run in multi-tenancy mode, the same resource is assigned to multiple users simultaneously from different locations. Service providers combine resources using virtualization and multi-tenancy techniques to sort customers and their data from others, thereby making it seem to users as if they are the only user of a shared computer and software application. Thus, IT resources are shared between multiple customers in different locations.

Multi-tenancy allows cloud service providers to obtain significant cost advantages and better profitability, allowing for more research and development investments (KPMG, 2011). The advantage is further passed on to the customer, making cloud computing services a cost effective alternative. The multi-tenancy approach allows for a thorough exploitation of IT resources compared to on-premise approaches. However, according to Jensen, Schwenk, Gruschka and Lacono (2010) even though cloud service providers use multi-tenant applications for cost reduction by using virtual machines, the vulnerability trait associated with cloud computing is still significant. This necessitates improved ways to handle multi-tenancy in distributed data systems.

3.5.2.5 Ease of Implementation and Use

The cloud makes a compelling business case based on implementation and system administration aspects. It is a lot easier to use cloud-based applications than to build new applications and data centers. Cloud computing makes instant software updates available, latest version availability, easier group collaboration, universal access to documents and eliminates the tether to specific devices (Miller, 2008). In addition, the management of all the resources offered is handled by the cloud service provider. In cloud computing, the user interfaces are user friendly compared to traditional software (KPMG, 2011), and users only need web browsers or other simple client applications in order to access the numerous applications provided.

Moreover, the software consistency between the users is assured and customers are guaranteed that all users will be supplied with the same version of the application. Also, the risk of data loss is reduced because the data backup is done in real time. Virtualization techniques hide the complex nature of the infrastructure including management and configurations, making it easier for users to develop new applications and reduce the responsibility of controlling the system as well. Currently, most cloud computing providers provide more flexible contract terms, to encourage organizations to adopt and implement cloud services to help in the expansion of their businesses (Leavitt, 2009).

3.5.2.6 Cost Reduction

Whereas cloud computing is seen as having the potential to convert capital expenditure (CAPEX) to operational expenditure (OPEX), a good adoption strategy may result in a reduced OPEX (Armbrust et al., 2010). Moving applications to the cloud reduces CAPEX, except when the cloud is built on-premise (i.e. private cloud). Similarly, depending on the type of cloud computing model adopted, a massive cost reduction can be reached in hardware and software provisioning. Moreover, cloud computing has the potential of reducing the overall management and maintenance costs. Financial gains can be a major driver for cloud adoption by cash constrained businesses like SMEs. This is further confirmed by International Data Corporation (2009), who confirm that the major reason for the adoption of cloud computing is cost-saving. Cloud computing has the ability to concentrate resources and create the chance to pay-as-you-go for computing resources and thereby remove the initial capital investment and reduce significantly the maintenance and operational costs of local computing infrastructure.

According to Keane (2011) cloud computing offers users infrastructural and help desk support in case of any difficulty while using the various cloud applications. These are some of the areas of cost reduction that cloud-based solutions try to tackle and in so doing, provide significant reductions in IT operational spending. According to Armbrust *et al.,* (2009) the decision to adopt cloud computing should be based on the fact that the average cost of the system after adoption is significantly lower than using in-house solutions and that the adoption process should be as simple as possible and without incurring much cost.

The next section looks into the factors that negatively influence the adoption of cloud computing services in SMEs.

3.5.3 Cloud Computing Adoption Concerns and Barriers

Cloud computing is an emerging technology and hence its adoption is surrounded with fears, uncertainties, issues and concerns (Sultan, 2011). The open nature of the technology raises security and privacy concerns (Kumar, Sehgal, Chauhan, Gupta and Diwakar 2011). According to Shimba (2010), the security, privacy and legal concerns associated with cloud computing affect the overall adoption of the technology. There is therefore a need to address some of these issues and concerns to enhance the success of the adoption process. The subsections that follow discuss some of the issues and concerns that impact the effective adoption of a cloud-based solution.

3.5.3.1 User Privacy Concerns

Privacy and security present the biggest concerns when it comes to the adoption of cloud services (Li, Sedayao, Hahn-Steichen, Jimison, Spence, & Chahal, 2009). These concerns threaten some of the cloud computing adoption drivers such as flexibility, ease-of-use and multi-tenancy. According to Li, *et al.* (2009), the issue of user privacy presents the concern that the adoption and use of cloud computing puts user data, information and intellectual property at risk.

This includes the need to protect user's information when integrating, and all user's transaction records when migrating to cloud computing (Takabi, Joshi, & Ahn, 2010). As a result, potential users are skeptical when it comes to storing their information in the cloud, and on another person's infrastructure. In cloud computing, data is stored and processed in the 'cloud' and therefore there is the danger of misuse, theft or illegal sale of customer's data. It also becomes difficult to get data back from the cloud and avoid vendor lock-in (Pearson, 2009).

According to Kresimir and Zeljko (2010), the cloud computing standard business model points to the fact that the service provider stands to profit from unlawful secondary usage of customer's data especially for commercial purposes. This leads to the illegal use of customer's data. The availability of various technologies makes it difficult to track this illegal secondary usage of data. Additionally, the issue of a service provider's financial flexibility is a concern. For example, what happens when there is vendor termination, the provider is declared bankrupt or data is in the hands of another company (Minqi, Rong, Wei, Weining & Aoying, 2010).

A common feature in cloud computing is the uncontrolled spreading of data among organizations without the consent of the data owner. However, even though the vendor guarantees to stop the use of copies of data in the datacenters, it is difficult to ascertain whether data duplicates are kept under the total control of the vendor. Because of the movement of data, cloud practitioners emphasize the need to consider trans-border data flow because it is difficult to identify which specific server or storage device will be used due to the dynamic nature of cloud computing (Popovic & Hocenski, 2010).

3.5.3.2 Data Security Concerns

According to Armbrust *et al.,* (2009) security is a major concern in cloud computing and is particularly so because most of the cloud offerings are public and therefore open to more attacks. Shimba (2010) added that the security, vulnerability and threat concerns facing cloud computing raises a sense of fear to potential users. This therefore influences the decision to adopt cloud computing.

Cloud computing services occur over and across networks and users access resources via the Internet from anywhere, making it prone to cyber-attacks. The security of data is therefore an issue that affects the whole cloud stack because it involves the use of a third-party service and infrastructure that are mostly used to host data or to perform important operations. Kumar, *et al*. (2011) also allude to this and point out that the off-premises nature of cloud computing leads to several concerns about the security of data, especially, the integrity and confidentially of data. This is because the cloud service provider has total control over the computing infrastructure that underpins the cloud-solution.

The processing of data by cloud service providers and the subsequent transmission over and across the networks, increases data and information vulnerability. This can also lead to unauthorised modification and data deletion. There is therefore a new challenge of security of data inherent in cloud computing (Ernst & Young, 2011). This has resulted in a situation where cloud service providers consider security as a major challenge that needs to be overcome in order to make potential and current users of cloud services more comfortable (Technologies, 2011).

Another concern with the use of cloud computing services is that services offered by service providers are not as secure as those controlled in-house (Callewaert, Robinson, & Blatman, 2009). According to Kumar, *et al*. (2011), there is the perception that cloud computing is by nature insecure.

3.5.3.3 Data Lock-in

The over-reliance on the services of one provider can sometimes lead to severe difficulties in changing the provider. There is the issue of customers having their data locked-in by service providers when they decide to terminate their contract with a particular provider. The customer thus becomes tied to a particular service provider. This often happens when providers do not meet the requirements of customers. Cloud computing infrastructures and platforms are such that they do not use standard methods of storing data and this makes user data not portable. There is therefore the need for standardization in the methods of storing data in the cloud (Buyya, *et al,* 2011).

Standardization would support interoperability and thereby reduce the fears that a service critical for a large firm may not be available for an extended period of time. According to Robinson, Lorenzo, Cave and Starkey (2010) standardization provides guidance on best practice in terms of the operational controls which should be employed to mitigate information risks. However, the lack of standards makes the integration with existing applications or switching between vendors difficult, thereby leading to vendor lock-in (Vaquero, *et al.,* 2009). Additionally, a missing exit strategy exacerbates this risk. A good Service Level Agreement (SLA) is therefore needed to guide both parties to reduce the confusion associated with data lock-in and to ensure that the right Quality of Service (QoS) is delivered (Kloch, Petersen & Madsen, 2011)

3.5.3.4 Confidentiality, Integrity and Availability Concerns

Confidentiality, integrity and availability becomes a concern when moving data across the Internet. Figure 3.9 shows these three factors which present important user concerns when it comes to the adoption of cloud computing. These factors are discussed in the sections that follow.

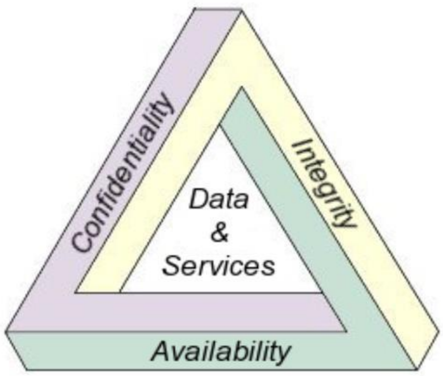


Figure 3.9: CIA Triad (Source: Steichen 2010)

3.5.3.4.1 Confidentiality

Confidentiality concerns not disclosing a user's information and data to unauthorised parties. It is expected that the cloud service provider puts measures in place such as network security protocols, network authentication services and data encryption services to ensure user's data is kept confidential (Johnson, 2010). Failure on the part of the service provider to keep data and information confidential may damage the provider's reputation and have legal implications (Wooley, 2011).

3.5.3.4.2 Integrity

Service providers must ensure that a user's data or information, either in storage or transmission, is not accidentally or intentionally changed or destroyed by unauthorised parties. They must be kept in a consistent and accurate form. Integrity in a cloud computing environment is therefore the assurance on the part of the service providers that data in their care will not be altered. This can be ensured by implementing firewall services, communication security and interference detection (Johnson, 2010).

3.5.3.4.3 Availability

Availability is key to the success of any platform irrespective of whether its users are on-premises or not. The performance of a cloud system can be measured using availability. Availability is the assurance on the part of the service provider that resources in the cloud will be made available to the customer in a timely and uninterrupted manner regardless of the location (Johnson, 2010). This implies that the service provider's infrastructure, security controls, and the networks connecting users and the cloud computing platform need to be always up and running correctly.

3.5.3.5 Losing Control of Data

Although the cloud provides a flexible utility of network-based resources, the fear of loss of control of data is an impediment that prevents users from migrating to cloud-based systems. According to Kumar, *et al.,* (2011) the service provider keeps all technical control and hence leaves an inherent risk of data exposure to third parties through the cloud computing platform or the cloud service provider. This is particularly true when it comes to transparency or visibility. In the cloud system, it may not be clear to the user where exactly data or services are hosted, or who controls them. Users therefore feel that their data could be compromised by the service provider, and other clients of the same provider, if they access it because of the open nature of cloud computing (Holbl, 2011). Similarly, the inherent greater technological complexity of cloud solutions as a result of its flexibility and scalability makes it difficult for users to identify the clear objective of the cloud system.

The fact that cloud computing involves an external source takes away the control from the user. Businesses lose control over the management of their IT infrastructure and depend solely on the service provider. Concerns will be heightened further if they need to commit to long term contracts or feel that switching to a new cloud provider may not be a direct process (Tsai & Lin, 2011). According to Holbl (2011) users are aware of the inherent risk associated with providers taking control of their data and storing sensitive data. Sultan

(2011) also noted that users are likely to be careful about giving control of their information to the cloud provider who can easily alter or reveal it without their consent.

Potential cloud users are also concerned about giving up physical access control. Users are worried about how to achieve requirements for physical access control since the cloud provider establishes and controls the when, who, why and how of physical access measures. Holbl (2011) was of the view that cloud computing is a service that is accessed remotely and therefore this poses a challenge as the connection between the provider and the user may not be well protected. Also, access to data by users is endangered by denial of service attacks and network downtime (Holbl, 2011).

Cloud computing is a cloud-based technology and therefore requires a constant Internet connection for users to access data or services. Kumar, *et al.,* (2011) explains that cloud computing relies largely on the reliability of a secure telecommunications network which promises uninterrupted operations for the cloud computing service provider.

3.5.3.6 Lack of Awareness

Cloud computing is a new paradigm that offers unique opportunities to small businesses by introducing technologies available to their larger counterparts and thus help create innovativeness, increase competitiveness and influence their operations and processes. However, because cloud computing is still a new innovation, the level of awareness of its existence is relatively low and is often misunderstood (Mark, 2013).

According to Nolan and O'Donnell (1991) small businesses are normally more dynamic, innovative and responsive to market changes than large organisations. Additionally, the dynamic nature of small businesses is supposed to allow them to easily adopt new innovations. However, according to Lumpkin and Dess (2004) the lack of awareness and knowledge of existence affect the early adoption of ICTs. Potential users need to know a lot about a technology and its benefits in order to decide whether to adopt or not. There is therefore the need for awareness and better understanding of the benefits of cloud computing to hasten the adoption decision.

3.5.3.7 Uncertainty

The adoption of any new technology comes with risks and uncertainties (Erumban & de Jong, 2006). The onus therefore lies on the adopters to search for additional information on how to manage the uncertainties associated with new technologies (Rogers, 2003). Uncertainty is the degree to which the results of using an innovation cannot be guaranteed (Fuchs, 2005).

The lack of knowledge about a particular innovation can also result in a less predictable outcome and may lead to uncertainty. This may eventually affect the decision to adopt and other related changes may entail some risk. According to Jalonen and Lehtonen (2011), the short lifetime of a new innovation may potentially produce some degree of uncertainty. Rogers (2003) identified uncertainty as a key barrier for innovation adoption: "*Consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation*" (Rogers, 2003:436). The existence of uncertainty as a result of security, privacy and lock-in concerns can negatively influence the decision to adopt cloud computing (Aziz, 2010).

3.5.3.8 Legal and Ethical Concerns

Even though there is an increasing interest in the adoption of cloud computing, certain factors continue to slow its adoption by small business. One such drawback is the risk that relates to the legal and regulatory aspects of cloud computing operations (Pigal, 2012). The network-based nature of cloud computing makes it accessible to external users and thereby the privacy of the data and its protection is affected. Furthermore, users are not aware of the exact location of their data and this could potentially lead to trans-boundary legal issues. The physical location of data should be a matter of concern as there are no clear internationally agreed rules about data privacy and protection. According to Jaeger, *et al.,* (2009) the physical location of the data center raises issues like access, reliability, security, data confidentiality, liability, intellectual property, ownership of data, fungibility and auditability for the user. These issues can be defined as follows:

1. *Access*: Cloud resources should be made accessible to the user wherever and whenever they wish without any form of hindrance from the service provider.

2. *Reliability*: It will be the expectation of users that the cloud providers provide a reliable cloud resource (Armbrust et al. 2009).

3. *Security*: It is the expectation of users that service providers will not allow unauthorized access to both data and code, and that sensitive data will remain secure (Jaeger et al., 2009). Users must therefore develop a comprehensive risk assessment to make an informed decision on the suitability or otherwise of adopting a cloud service and examine the appropriate security protection it entails (Snooks, 2013).

4. *Data confidentiality*: Users may have contractual, equitable or statutory obligations to ensure information remains confidential. Thus, these requirements must be transmitted to the service provider in situations where the provider is storing or

accessing a user's data. A user in this case will expect that the service provider will not monitor their activities except when the cloud provider decides to monitor usage for quality control purposes (Armbrust et al., 2009)

5. *Liability*: Cloud service agreements usually try to minimize the provider's liability for any loss that may occur in the process of providing the service. There is therefore the need for standard exceptions during the contractual agreements. Additionally, decisions by users on the amount of any liability must be informed by a risk assessment that assesses all potential liabilities and determines the likelihood and effect of those risks being realized (Snooks, 2013).

6. *Intellectual property*: It will be expected by all parties, including users and third party content providers that their intellectual property rights are upheld (Jaeger et al., 2009).

7. *Ownership of data*: It is the expectation of the user to be able to adjust and control the information that is created and altered using those services (Jaeger et al., 2009; Armbrust et al., 2009).

8. *Fungibility*: It is the expectation of the user to have data and resources stored in an aspect of the cloud to be transferred to another service without difficulty.

9. *Auditability*: It is the expectation of corporate users that the service provider will either abide by the regulations or give the opportunity to be audited for each regulation requirement (Armbrust et al. 2009).

Even though the geographical location of the cloud has an effect on the rules and regulations governing the movement of data, it is uncertain whether a cloud will be considered to legally be in one designated location or in every location that has a data center that is part of the cloud (Jaeger *et al.,* 2009). It must be noted however that it will be impossible to stop the use of cloud services as a result of jurisdiction issues. At the same time these issues will have a long-term implication on cloud use.

3.5.3.9 Poor Connectivity and Slow Internet Speed

The unavailability of Internet especially in developing countries is a major factor that negatively impacts on the decision to adopt Internet technologies (Uzoka, Seleka & Shemi, 2007). In order to operate cloud computing, there is a need for a constant supply of power and a running or reliable network connection. However, in developing countries, there is unstable and slow network bandwidths and frequent power outages (Yeboah-Boateng & Essandoh, 2014). Poor broadband connectivity is a concern to organizations in developing economies in their attempt to access software and other applications remotely (Veigas, Naik & Chandrasekaran, 2012) and this leads to immediate interruption of cloud service (Yeboah-Boateng & Essandoh, 2014). This affects businesses economically especially during long downtimes and causes customer dissatisfaction (Sultan, 2011). Additionally, the slow Internet speed does not encourage or promote the adoption of Internet technology (Oreku, Li, Kimeli & Mtenzi, 2009).

3.5.3.10 Complexity of Technology

There is often perceived complexity associated with cloud computing. Firms are therefore skeptical about adopting because of the fear of their inability to manage issues between the old and new technology applications (Forman, 2005). The fear of the technology can negatively influence the decision of managers to adopt cloud computing. However, when business managers have some technical knowledge, they can easily appreciate the competitive advantage they stand to attain when they make it a business strategy to migrate to the cloud. Jennex and Amoroso (2002) stated that there is a need for organizations to incorporate technological issues in their technological adoption strategy.

3.6 Information Management in the Cloud

Businesses are increasingly dependent on information as a result of the on-command, on-demand nature of the business environment. This means that information is needed when and where it is required. Although the majority of information is generally created by individuals rather than organizations, it is stored and managed by a relatively small number of organizations. The emergence of cloud computing has resulted in increases in the volume of data and various types and sources of information (EMC, 2012). These factors make modern storage technologies more important and relevant for the success of organizations.

Businesses depend on fast and reliable access to information critical to their success. According to EMC (2012), the increasing dependence of businesses on information has amplified the challenges in storing, protecting and managing data. It was further added that legal, regulatory and contractual obligations pertaining to the availability and protection of data further add to these challenges. Cloud computing reduces the complexity associated with the storage and management of information and IT resource provisioning time. It enables firms to deploy applications where the primary storage capability can scale-up and scale-down, depending on the business requirements.

According to EMC (2012), all the management tasks in a typical storage infrastructure can be broadly categorized into:

1. *Availability management:* refers to the act of establishing proper guidelines for all configurations to ensure availability based on service levels.

2. *Capacity management:* seeks to ensure adequate availability of resources for all services based on their service level requirements. It provides capacity analysis, and compares allocated storage to forecasted storage on a regular basis. It also provides trend analysis of actual utilization of allocated storage and rate of consumption, which must be rationalized against storage acquisition and deployment timetables.

3. *Performance management:* ensures the optimal operational efficiency of all components. Performance analysis is an important activity that helps to identify the performance of storage infrastructure components. This analysis provides information about whether a component is meeting expected performance levels.

4. *Security management:* prevents unauthorized access and configuration of storage infrastructure components.

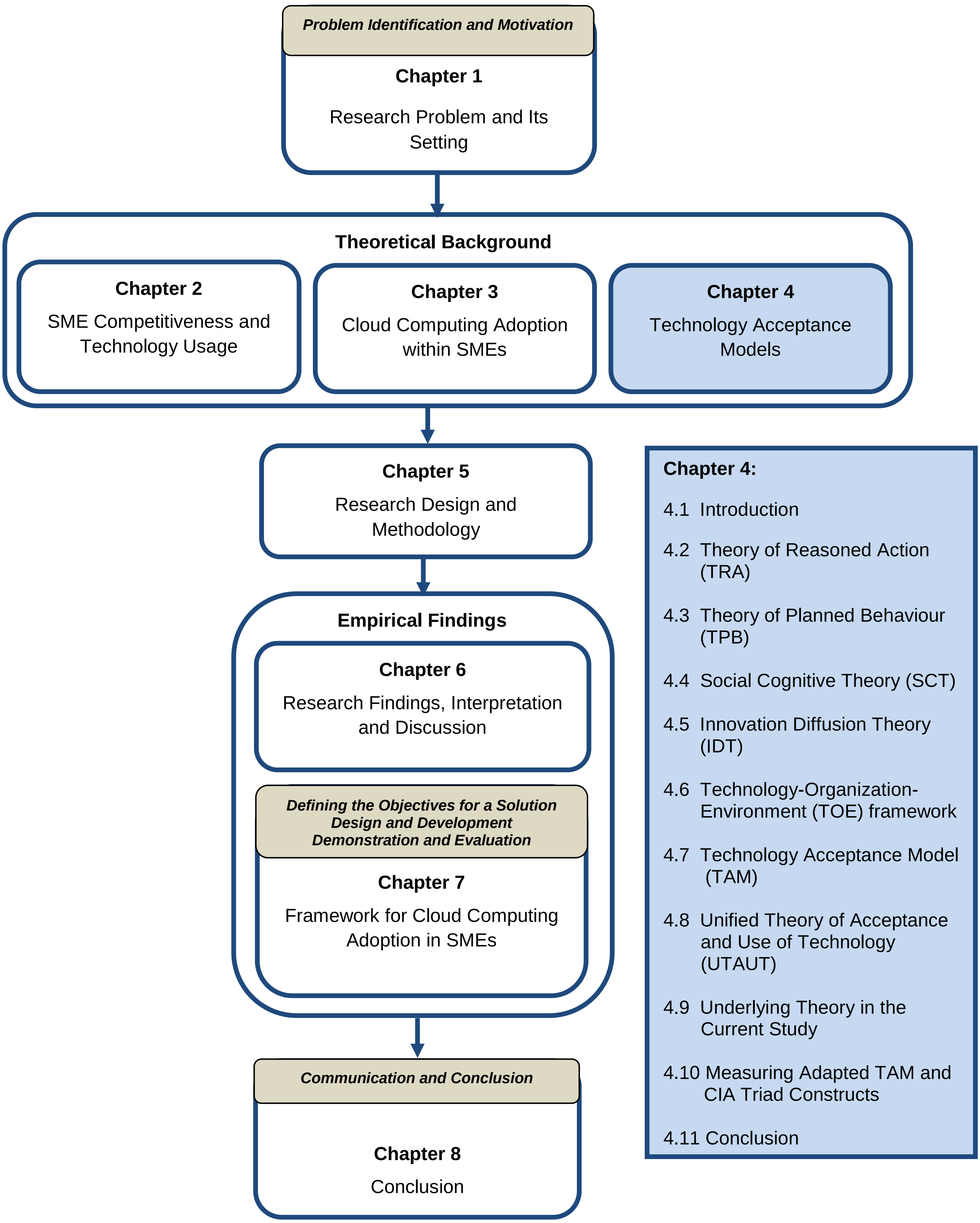
5. *Reporting:* involves keeping track and gathering information from various components or processes. This information is compiled to generate reports for trend analysis, capacity planning, chargeback, performance, and to illustrate the basic configuration of storage infrastructure components.

3.7 Conclusion

This chapter provided an introductory background to cloud computing. This includes a formal definition of cloud computing, description of the main characteristics, as well as the different types of cloud computing deployment models available. The relevant cloud computing delivery models, namely SaaS, PaaS and IaaS were also discussed.

Cloud computing is essentially an Internet-based innovation that offers a platform for computing, networking, and storage of technologies intended to offer speedy time to market and drastic cost reductions for SMEs. Cloud computing therefore offers an attractive and compelling option for SMEs in their adoption of technology. This chapter therefore briefly examines the adoption of cloud computing by SMEs and in particular, what drives SMEs into adopting this technology. However, despite its attractive nature, cloud computing comes with unique concerns which discourages its adoption. These concerns were therefore reviewed. The chapter also reviewed the concept of cloud computing and how its adoption can serve as a competitive tool for SMEs.

Cloud computing is a new technology and like any technology, there is the need for a better understanding of the theories behind its adoption in order to identify the relevant factors influencing adoption. The next chapter (Chapter 4) examines the various theories that underline the adoption of technology.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Chapter 4: Technology Acceptance Models

4.1 Introduction

In the previous chapter, it was revealed that cloud computing is a new technology that allows SMEs to improve performance. As such, there is the need for a better understanding of the theories behind its adoption to help identify the relevant factors influencing adoption. The review of cloud computing adoption literature calls for the need to be open to different approaches of technology adoption to understand the relevant factors.

Technology adoption brings about the development of different models related to Information Technology (IT) and Information Systems (IS) diffusion. Literature reviewed indicates that there is a rich stream of research that studies technology acceptance and adoption at individual and societal levels (Compeau & Higgins, 1995), while others stress the successful deployment within firms. While many of the research models (such as Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB)) were developed from a social psychology perspective, others (such as Social Cognitive Theory (SCT) and Innovation Diffusion Theory (IDT)) originated from sociology. On the other hand, the Technology Acceptance Model (TAM) and Technology-Organisation-Environment (TOE) Framework specifically apply to technology adoption.

In the development of these models, many studies were done to explain end-user's behaviour in the adoption process. The development of these models presented literature on technology acceptance, with many of them theorizing behavioural intention and/or usage as the key dependent variable in explaining acceptance of technology. This is because behavioural intentions are motivational factors that explain the willingness of people to try to perform a behaviour (Ajzen, 1991).

This study seeks to propose a framework for the adoption of cloud computing by SME. This chapter is relevant to the study in that it will help develop the theoretical basis for studying the factors that influence the adoption of cloud computing by small and medium-sized enterprises (SMEs). This chapter reviews the abovementioned technology acceptance models. It will be followed by highlights of the applicability of the underlying theory, TAM and Confidentiality Integrity and Availability (CIA) Triad, in SMEs and a summary of the chapter.

4.2 Theory of Reasoned Action (TRA)

The TRA was developed to explain user behaviour after the adoption of technology. It aims to offer a better understanding of the relationship between attitude, intention and behaviour (Glanz, Rimer & Viswanath, 2008). It is based on the assumption that people are rational enough to make systematic use of the information at their disposal (Ajzen and Fishbein, 1980). Ajzen and Fishbein (1980) further argue that people usually think through the implications of their actions before engaging in a behaviour. The model identifies behavioural intention (BI) as the main dependent variable and attitude towards behaviour (A) and subjective norm (SN) as the main independent variables.

TRA explains a person's behaviour as determined by his or her behavioural intentions (BI) to partake in an action. The intentions are determined by the person's attitudes (A) and his subjective norms (SN) towards behaviour. Thus:

Attitude → Intention → Behaviour

The relative weights can be represented algebraically as

$$BI = A + SN$$

Thus, the attitudes and subjective norms and their relative weights directly affect behavioural intention.

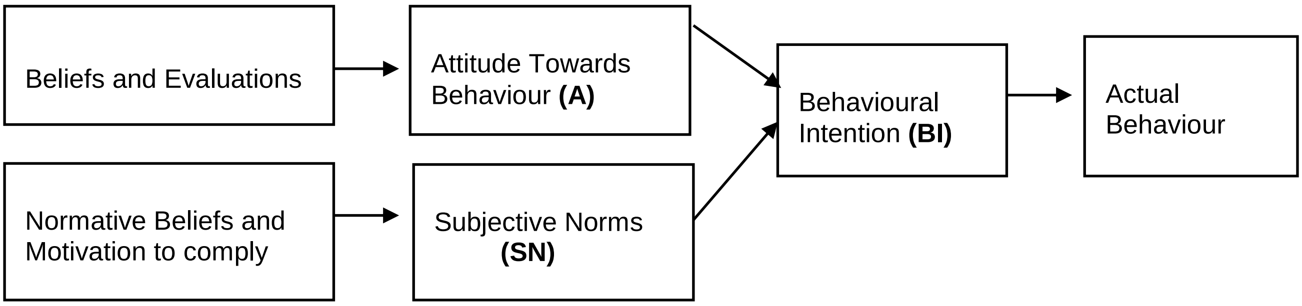


Figure 4.1: Theory of Reasoned Action (Source: Ajzen and Fishbein, 1980)

Attitude towards behaviour is defined as a "learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object" (Chau & Hu, 2001:6). This can be determined by assessing a person's beliefs about the outcome from a behaviour and evaluating the desirability of these outcomes. Intention is a sign of a person's willingness to perform a certain behaviour. Subjective norm tackles the impact of the social environment on behaviour. It is an individual's perception of how people relevant to the individual think the behaviour should be performed (Dillon & Morris, 1996).

TRA is used to explain the individual's behaviour after adopting a technology. However, Shantanu, Shivraj and Subhasish (2003), argue that there is a need for modification of TRA to serve different innovations. The main limitation of TRA is the perception that behaviour is under volitional control. As a result, the model only applies to behaviour that is deliberately thought out in advance (Al-Qeisi, 2009). These limitations produce mixed results on the effect of subjective norms on behavioural intention (Podder, 2010). The TPB was therefore developed with an extra construct, perceived behavioural control, to help resolve the inherent limitations of TRA.

4.3 Theory of Planned Behaviour (TPB)

The TPB attempts to resolve the limitations of TRA by introducing a third construct, namely perceived behavioural control (Ajzen, 1991). TRA was developed to promote better understanding of volitional behaviours and not those resulting from situational factors external to the control of the subject. Additionally, TRA left out the social nature of human action (Kippax & Crawford 1993). Behavioural and normative beliefs is as a result of the individual's perceptions of their social environment and are therefore likely to show the effect of economic and other factors on choices. TPB therefore introduced a construct, namely perceived behavioural control, to predict behaviours in which individuals have incomplete volitional control. Figure 4.2 illustrates the additional dimension of perceived behavioural control.

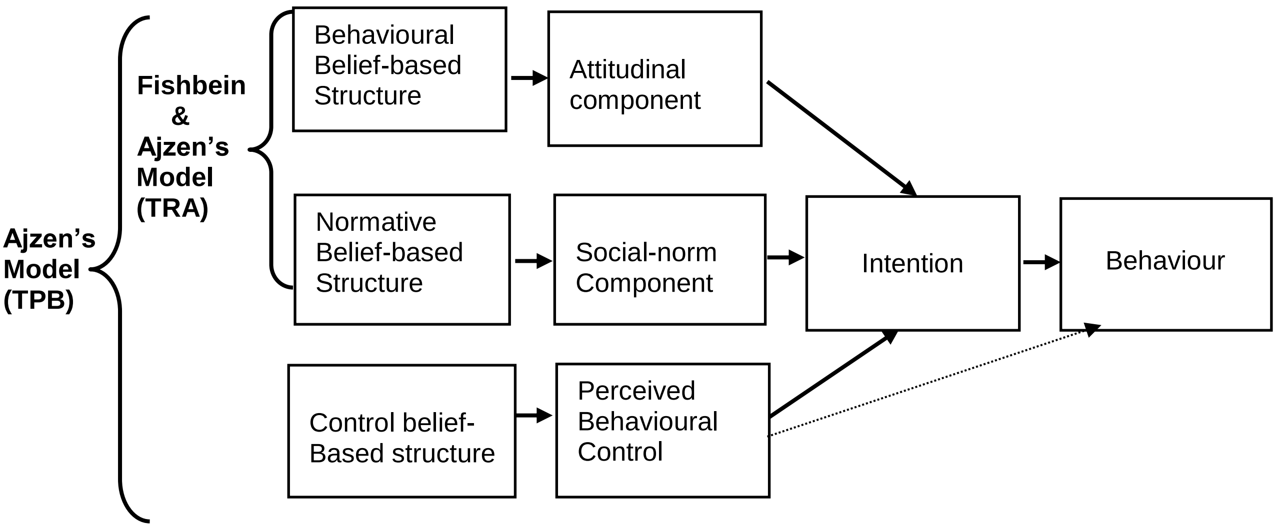


Figure 4.2: The Theory of Reasoned Action and the Theory of Planned Behaviour (Godin, 1993)

The additional construct in TPB takes into account situations where the adopter has limited control over the behaviour. This changes according to the situation and action (Ajzen, 2002). From figure 4.2, a person's behaviour is influenced by three variables: attitude towards the behaviour, the subjective norms surrounding the performance of the behaviour and behavioural control. Eagly and Chaiken (1993) summarised the definitions of these variables as follows:

1. *Attitude towards behaviour* is the positive or negative thought about engaging in a behaviour and can be assessed through the feelings about the effect of the behaviour and the benefits of the outcome of the behaviour.

2. *Subjective norms* are the perception of what others think of how a behaviour should be performed.

3. *Behavioural control* is a person's opinion of the difficulty level of performing a particular behaviour. This factor was included to cover all the non-controllable factors of behaviour (Taylor & Todd, 1995).

It is believed that the constructs of TPB will help initiate a behavioural intention for adopters of different innovations. Usually, users carry out their intention when they have full control to perform it. In certain cases however, users encounter some difficulties in executing their actual intentions. Ajzen (1991) concluded that the behavioural control is in accordance with the self-efficacy element found in the social cognitive theory. This is however sharply criticized by Armitage and Conner (2001) who are of the view that self-efficacy describes the internal control factors while behavioural control concerns external factors (Al-Qeisi, 2009).

Sniehotta (2009) reported the existence of some limitations in TBP. Firstly, he identified that TPB does not specify methods for modifying hypothesized cognitive causes of intention and behaviour. A second limitation with TPB is that any attempt at changing beliefs will be weakened by the series of events from beliefs through to intention as a result of the relationship between the constructs. TPB also does not also consider the inconsistencies which account for intention and behaviour (Sniehotta, 2009). Finally, TPB fails to classify detailed elements that might determine behaviour.

4.4 Social Cognitive Theory (SCT)

In 1986, Albert Bandura officially came up with the SCT, with its basis taken from behavioural and social psychology. The SCT was formulated to explain how behavioural patterns are attained and sustained and how to implement intervention strategies. Behaviour, environmental and personal influences form the constructs of SCT and uniquely identifies a person. According to SCT, behaviour is regulated through cognitive processes. Humans' ability to predict the outcomes of their behaviour is through their ability to perform to these expectations.

The SCT emphasizes that the mind is an active force that constructs reality, converts information and performs behaviour through actions (Jones, 1989). A person's reality is formed through responses from interaction with the environment and one's intuitions.

Additionally, a person's behaviour is understood or predicted through the processes involved in the construction of reality.

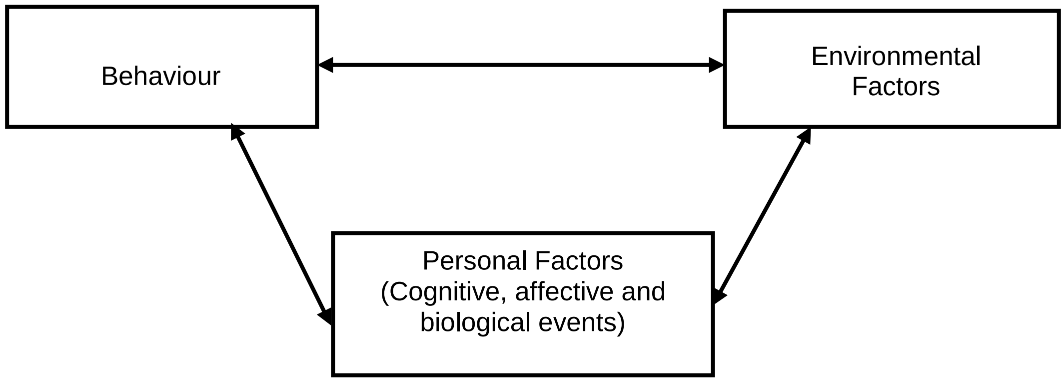


Figure 4.3: Social Cognitive Theory (Source: Pajares, 2002)

From figure 4.3, it can be seen that behaviour has multiple effects on one's thoughts, emotions and actions (Bandura, 1986; 1989). Thus, a person's behaviour affects emotions and thoughts. Additionally, environmental factors influence a person's expectations and beliefs.

According to Bandura (1986; 1989) a person can serve as a product or a producer in an environment. The part of the environment people find themselves in has an effect on their behaviour. Also people behave the way they understand events in their environment. In their attempt to participate in events in their environment, people have the preference to select who to interact with. Hence, a person contributes to their own motivation, behaviour and development and they do this with influences from things they interact with in the environment.

4.5 Innovation Diffusion Theory (IDT)

The IDT was developed by Rogers (1983, 2003) to explain the user adoption and decision making process of adopting an innovation. IDT explains the processes of decision making, the factors that determine the rate of adoption, types of adopters, the prediction of the probability and the rate of an innovation being used. According to IDT, the entire adoption process is characterized by the characteristics of the innovation, the user's attitude and beliefs and the interaction with the environment.

IDT identifies relative advantage, complexity, trialability, compatibility and observability as characteristics inherent in innovation (Rogers, 1995). These factors are employed to explain the user adoption and the decision process to adopt an innovation. They are also employed to predict the implementation of new technological innovations and explain how these variables relate to each other. Rogers (1995) concluded that these factors influence the rate of adoption of an innovation. Some factors such as the adaptation of the innovation to meet the needs of the user can also affect the rate of adoption. Similarly, a new innovation has the potential of affecting the rate of adoption of an old innovation. The diffusion model places greater emphasis on innovation as an agent of behaviour change (Rogers 2003). As a result, it is perceived attributes of an innovation that determine its rate of adoption to a higher extent than the features of the adopters (see Figure 4.4).

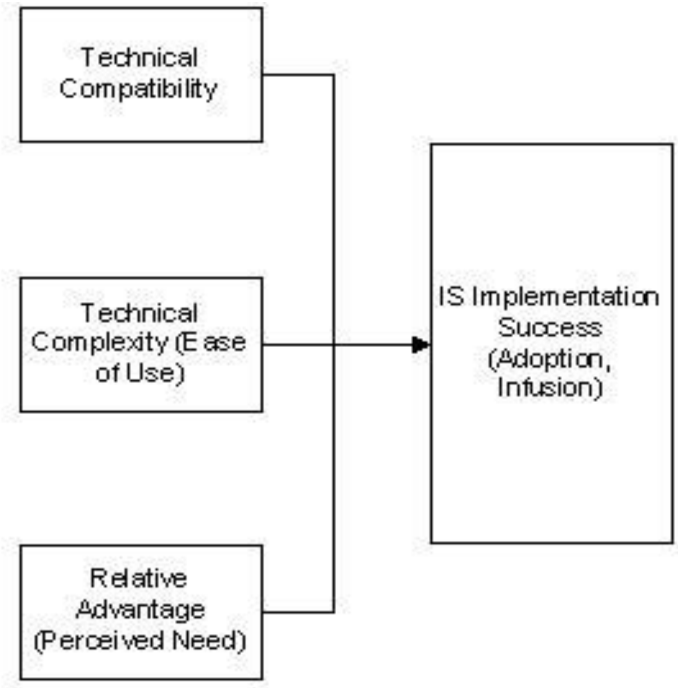


Figure 4.4: Information Systems Diffusion Variance Model (Agarwal and Prasad, 1999)

4.6 Technology-Organisation-Environment (TOE) Framework

A framework for organizational adoption was developed by Tornatzky and Fleischer (1990) based on the Contingency Theory of Organizations. The effectiveness of an organization is based on its fitness towards both internal and external factors such as environment, organization size and organization strategy (Donaldson, 2001). Hence, decision makers need to take into consideration environmental, organisational and technological factors to take a decision.

The framework, known as TOE, identifies three aspects of an enterprise as affecting its decision to adopt and implement a technological innovation: technology, organization and environment (see Figure 4.5).

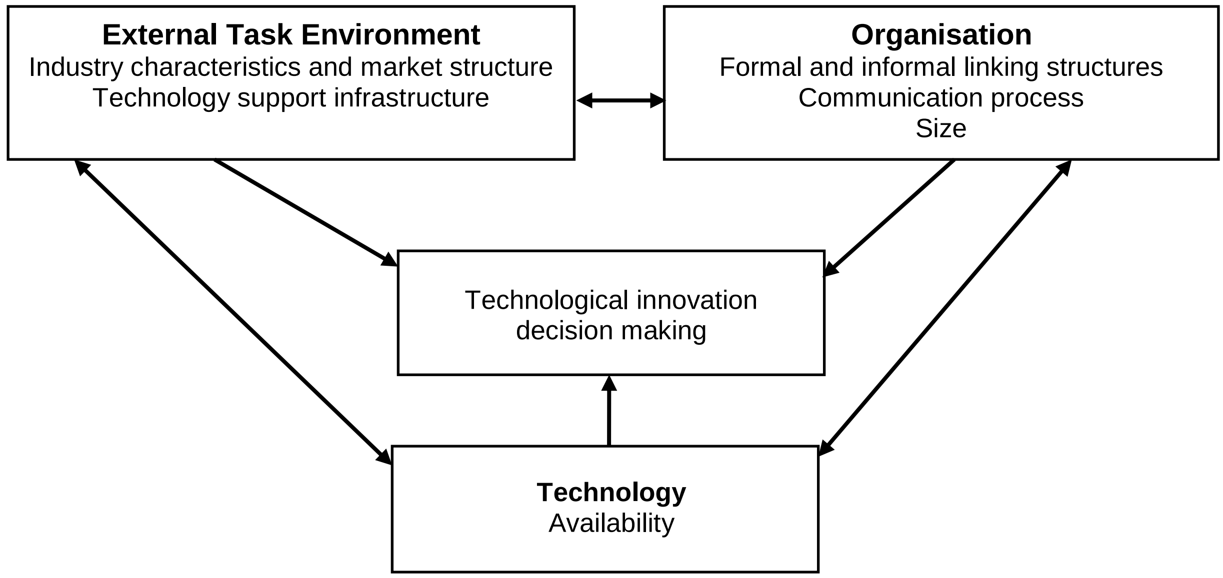


Figure 4.5: Technology Organization Environment Framework (Tornatzky & Fleischer, 1990)

In this framework, the technological aspect describes the technologies available to an enterprise and how ready these technologies are for adoption. This is available technological infrastructure and technical skills. The features of existing resources are essential to adopting cloud services (Misra & Mondal, 2011). The infrastructure serves as the platform upon which the technology runs while the human capital is the skills needed to operate the technology (Zhu & Kraemer, 2005).

The organisational context describes the organization using the technology and takes into account the size, location and managerial structures of the organization. The size of an organization, whether small or large, is a strong factor that influences adoption (Saini, Khanna & Kumar, 2012). Due to size, organizations critically examine the benefits of the innovation, availability of financial capital and the size of their operation before deciding on an innovation. For bigger organizations, bureaucracy in the organizational structure hinders the rate of adoption of innovation while smaller organizations consider whether the innovation will integrate properly with their operations.

The environmental context of the framework explains the surroundings where the organization does its business and includes the competitors and laws in the area of operation (Tornatzky & Fleischer, 1990). These are external factors that influence the innovation. Adoption of innovation is higher in emerging industries compared to established or declining industries (Baker, 2012). Adopting a new innovation has the likelihood of overcoming competitors, thus changing the competitive landscape.

4.7 Technology Acceptance Model (TAM)

The technology acceptance model (TAM) is an adaptation of TRA (Koh, Prybutok, Ryan & Wu, 2010) to explain the determinants of technology adoption and usage and also the behaviour of users of computing technologies. Normally a model is expected to predict and explain the suitability or otherwise of a system and suggest appropriate ways of using such a system. It is for this reason that TAM was developed for investigating the effect of external factors and internal beliefs, attitudes and intentions. TAM was developed to help identify determinants of computer technology acceptance by adapting TRA as a support to establish the theoretical relationship among the variables.

TAM proposed two ideas, namely perceived usefulness and perceived ease of use, as relevant when it comes to behaviour towards accepting technology (see Figure 4.6). TAM recognizes perceived ease of use and perceived usefulness as determinants of an individual's technology acceptance (Surendran, 2012) by determining their attitude towards using and subsequent behavioural intention to use and actual system use (Wu & Wang, 2005). Perceived Usefulness is used as both a dependent and an independent variable since it is predicted by perceived ease of use and in turn predicts attitude towards using and behavioural intention to use simultaneously (Davis et al., 1989; Koh et al., 2010; Lee et al., 2003). The perceived ease of use and behavioural intention to use components represent the core functions of the technology acceptance model, whereas external variables and actual system use serve merely as input to and output from the model respectively.

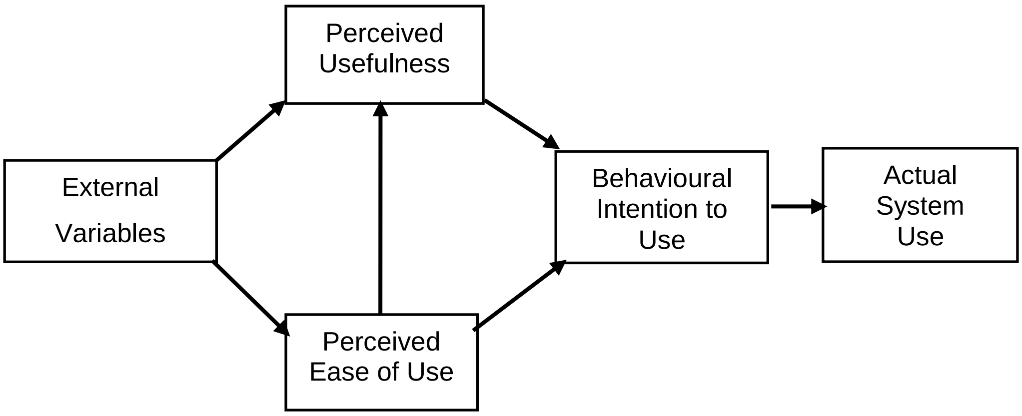


Figure 4.6: Technology Acceptance Model (Source: Davis, 1989)

In their study to explain behavioural intention in a procurement environment, Gentry and Calantone (2002) established that TAM is ideal for explaining a variance in behavioural intentions. They argue this might be as a result of TAM's use of two specific beliefs in varying contexts. Despite its successful use in explaining the acceptance of technology in different contexts, TAM has issues in terms of its appropriateness and comprehensiveness.

Some researchers have questioned the assumption that the two elements are the only key determinants of technology acceptance (Park *et al.,* 2007). Davis (1989) contends there is need for research aimed at identifying more determinants that may have an effect on these two key determinants, as this has the potential to improve the model's effectiveness at explaining the acceptance of technology. As a result, scholars concluded that TAM is limited and therefore there is a need to include other variables to better explain the behavioural intention to accept and use technology (López-Nicolás *et al.,* 2008). Venkatesh *et al*. (2003) stated that unlike TRA, TAM's final conceptualization excludes the attitude element as an attempt to describe intention. As a result of these criticisms, new determinants are constantly being added to TAM.

Due to the exclusion of some major determinants, other researchers have criticized TAM. According to Venkatesh *et al.* (2003), the model provided little reflection on how the design and implementation of a system can influence the usage of that system. A second limitation of TAM is the link between individual reactions to using information and intentions. For instance, adopters may consider a lot of different factors that may influence their decision, but TAM identifies only two factors (Bagozzi, 2007). Bagozzi (2007) further argues that the model does not make provision for the group, cultural, or social aspects of technology acceptance.

Table 4.1 shows how various studies which, though based on different theories and examining different constructs, reflect on TAM and its constructs.

Table 4.1: Theory-Based Research (Source: Own Creation)

Theory Name	Main Constructs	Reference	Studies
TPB	**Main dependent construct (s)/factor(s):** Behavioural Intention, Behaviour **Main independent construct (s)/Factor(s):** Attitudes towards Behaviour, Subjective Norms, Perceived Behavioural Control	Bobbitt and Dabholkar, 2001	The study used the TPB theory to investigate and predict the use of technology-based self-service. The outcome was a conceptual model that explained user decisions related to using technology-based self-service by carefully examining underlying consumer attitudes.
		Brown and Venkatesh, 2005	This study used the TPB model to give a better understanding of the comparative factors involved in the process which the life cycle stages control and regulate the adoption of technology in the household.
		Riemenschneider and McKinney, 2001	This study used the TPB model to investigate variances in the beliefs of small business executives about the implementation of Web-based electronic commerce. This study sought to draw a comparison between the beliefs of small firm executives that had previously implemented Web-based electronic commerce and those yet to adopt.
		Chau and Hu, 2001	This study sought to investigate the adoption of technology by individual professionals. The study tried to establish comparisons in some earlier studies that were based on TAM, TPB, and a decomposed TPB model,

			possibly suitable in the targeted healthcare professional setting.
		Workman, 2005	This study used TPB to develop hypotheses about the use, disuse, and misuse of an expert system decision support system.
TRA	**Main dependent construct (s)/factor (s):** Behavioural Intention, Behaviour **Main independent construct (s)/factor(s):** Attitude Towards Behaviour, Subjective Norm	Liker and Sindi, 1997	This study used the TRA theory to explain user acceptance of specialized systems.
		Mykytyn Jr. and Harrison, 1993	This study used the TRA model to explain the acceptance of strategic information systems by senior management.
		Shantanu et al., 2003	This study used the TRA model to investigate and evaluate the differences between user participation and involvement of enterprise resource planning (ERP) systems and other information systems.
		Celuch and Taylor, 2004	This study tried to compare the constructs of two models adapted from the TRA. They include the attitude and subjective norm aspects and the TPB, which includes TRA facets and also explains the perceived behavioural control construct that consists of self-efficacy and perceived control.
TAM	**Main dependent construct (s)/factor(s):** Behavioural Intention to Use, Actual System Usage **Main independent construct (s)/factor(s):** Perceived Usefulness, Perceived Ease of Use	Dennis, Nelson and Peter, 1992	This study sought to examine the outcome of two studies that replicated a similar study by Davis on perceived usefulness, ease of use and system usage of technology. The two studies concentrated on the psychometric properties of the ease of use and usefulness attributes, while investigating the relationship between usefulness, ease of use and actual system usage.
		Agarwal and Prasad, 1999	This study used the TAM to develop a theoretical model of the relationship between individual differences and technology acceptance.
		Chau and Hu, 2001	This study investigated technology acceptance by individual professionals. The study tried to establish comparisons in some earlier studies that were based on TAM, TPB, and a decomposed TPB model, possibly suitable in the targeted healthcare professional setting.
		Venkatesh et al., 2003	This study sought to re-examine an earlier study by Venkatesh and Speier (1999) and to improve an integrated framework of technology acceptance. This framework was developed to help study the influence of pre-training and training environment interventions to see client perceptions really are before the deployment of a system.
		Taylor and Todd, 1995	This study used TAM and two variations of the TPB to determine the best model that helps explain the adoption of technology.

To provide further insight into TAM, the next section explains the Unified Theory of Acceptance and Use of Technology

4.8 Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated to provide a unified view to facilitate research on user acceptance of information system (IS)/information technology (IT). It aims to explain the user intentions to use an IS and subsequent usage behaviour. The theory was developed through the review, mapping and integration of the constructs of eight dominant models that earlier research had employed to explain IS/IT usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a combined theory of planned behaviour/technology acceptance model, model of PC utilization, innovation diffusion theory and social cognitive theory). The theory postulates that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of IS/IT acceptance (behavioural intention) and ultimately use (behaviour) (Venkatesh et al. 2003). The theory also assumes that the effect of these four constructs is moderated by gender, age, experience, and voluntariness of use (Venkatesh et al., 2003).

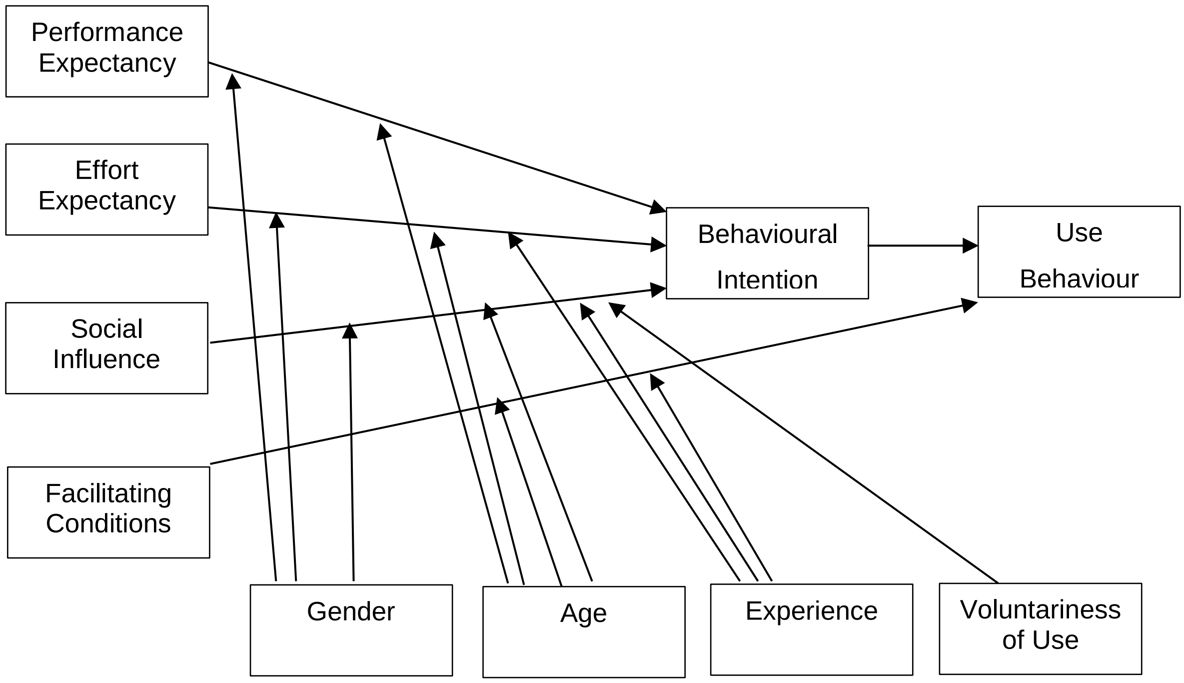


Figure 4.7: Unified Theory of Acceptance and Use of Technology (Source: Venkatesh et al. 2003)

The models integrated to develop UTAUT have been successfully utilised by a large number of previous studies of technology or innovation adoption and diffusion within both the IS/IT field and other disciplines including marketing, social psychology and management. The motivation to define and validate UTAUT was based on the argument that many of the constructs of existing theories are similar in nature; therefore, it was logical to map and integrate them to create a unified theoretical base (Venkatesh et al., 2003). By doing so, creators of UTAUT hoped that future studies would not need to search, collate and integrate constructs from numerous different models but instead could apply UTAUT to gain an understanding of a variety of problems related to IS/IT adoption and diffusion.

With the different theory-based research discussed in the sections above, the next section explains the underlying theory for this study.

4.9 Underlying Theory in the Current Study

This research project will make reference to TAM and the CIA Triad throughout in order to highlight the academic significance of the topic under discussion. These theories are discussed, particularly with reference to their relevance for this study, in the sections which follow.

4.9.1 Technology Acceptance Model (TAM)

Although originally developed to explain the determinants of technology adoption and usage and also the behaviour of users of computing technologies, TAM has extensively been used for studying acceptance of technology in small businesses. Benamati and Rajkumar (2008) state that the decision to outsource IT in organizations is usually made by single individuals at executive levels. Thus the use of TAM, which is developed to gather views of individuals, is appropriate to evaluate acceptance of certain organization-wide technology decisions (Benamati & Rajkumar, 2008).

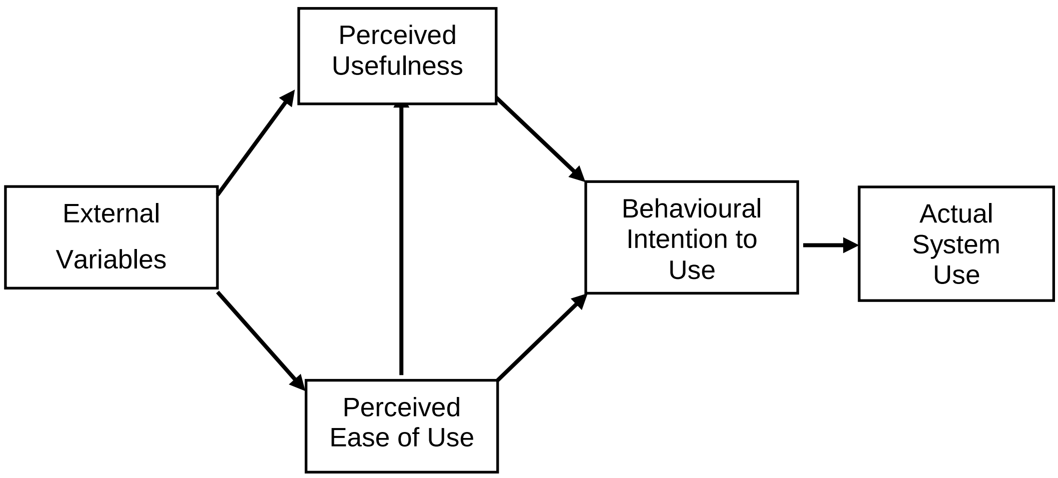


Figure 24.8: Technology Acceptance Model (Source: Davis, 1989)

Researchers have also extended TAM by adding more variables to better explain the behavioural intention to accept and use technology. In their investigation of the acceptance of cloud computing in German IT departments using Technology Acceptance Model 2 (TAM2), Opitz, Langkau, Schmidt and Kolbe (2012) suggested that the variables should be rearranged. Optiz *et al.* (2012) in their study did not however address the issue of security and privacy. Issues of security, privacy and data integrity make businesses reluctant to adopt this relatively new technology (Truong, 2010). Additionally, TAM has been criticized for not addressing concerns of security and trust (Benamati & Rajkumar, 2008). The current study will therefore extend the original TAM with an additional variable. The variable is perceived trustworthiness, which includes confidentiality, integrity and availability. Together, these variables serve as predictors of a user's intentions to adopt and use cloud computing.

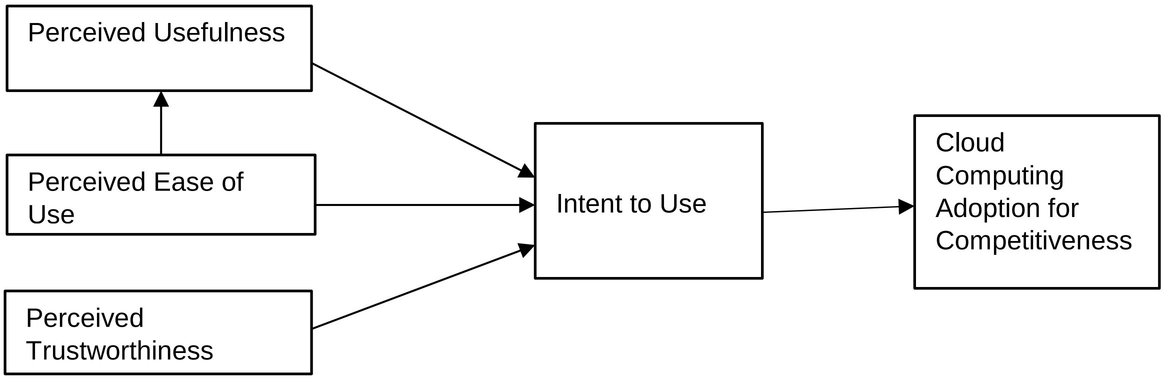


Figure 4.9: Proposed conceptual TAM for Current Study (Source: Adapted from Davis, 1989)

4.9.2 The Confidentiality Integrity Availability (CIA) Triad

The CIA Triad is an industry-accepted model for ensuring security in systems (Steichen, 2010). It specifically focuses on the storage and management of data. Confidentiality, integrity and availability become an issue when transferring data across the Internet. Figure 4.9 shows these three factors which present important user concerns when it comes to the adoption of cloud computing.

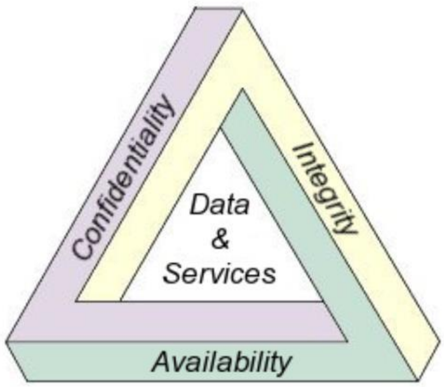


Figure 4.10: CIA Triad (Source: Steichen 2010)

The three constructs can be defined as follows:

1. *Confidentiality*: Confidentiality concerns not disclosing a user's information and data to unauthorised parties. It is expected of the cloud service provider to put measures such as network security protocols, network authentication services and data encryption services in place to ensure user's data is kept confidential (Johnson, 2010). Failure on the part of the service provider to keep data and information

confidential may damage the provider's reputation and have legal implications (Wooley, 2011).

2. *Integrity*: Service providers must ensure that a user's data or information, either in storage or transmission, is not accidentally or intentionally changed or destroyed by unauthorised parties. They must be kept in a consistent and accurate form. Integrity in a cloud computing environment is therefore the assurance on the part service providers that data in their care will not be altered. This can be ensured by implementing firewall services, communication security and interference detection (Johnson, 2010).

3. *Availability*: Availability is key to the success of any platform irrespective of whether its users are on-premises or out. The performance of a cloud system can be measured using availability. Availability is the assurance on the part of the service provider that resources in the cloud will be made available to the customer in a timely and uninterrupted manner regardless of the location (Johnson, 2010). This implies that the service provider's infrastructure, security controls, and the networks connecting users and the cloud computing platform need to be always up and running correctly.

4.9.3 Justification for the Use of TAM for the Current Study

Research on the acceptance of technology has yielded many models of attitudes, perceptions and the use of IT system (Meade & Islam, 2006). TAM was used for this study because unlike the TOE and DOI that focuses on the adoption of technology at the organizational level, TAM, TPB and UTAUT are models used at the individual level. Also the use of TAM has proved to be the most extensively used model for explaining the predictors of system usage behaviour, because of its meticulousness (Etsebeth, 2012), parsimony and its magnitude of empirical support (Taylor & Todd, 1995). It is a powerful, robust and commonly employed model for predicting and explaining user behaviour towards information system usage (Surendran, 2012; Tome, Johnston, Meadows & Nyemba-Mudenda, 2014; Erasmus, Rothmann & Van Eeden, 2015).

Additionally, due to the increased need for its use, TAM has been extended for studies in complex (Wu & Wang, 2005), mandatory (Lee, Kozar & Larsen, 2003) IT settings to address specific research objectives. TAM has been successfully tested, across a wide range of technology solutions, by previous studies such as those in Singapore, United States of America, United Kingdom, Malaysia, Hong Kong, Japan, Switzerland and the Arab world.

However, from available literature, there is little evidence that TAM has been tested in developing countries and specifically in Ghana (Averweg, 2008).

4.10 Measuring an Adapted Technology Acceptance Model and the CIA Triad Constructs

The Technology Acceptance Model (TAM) and Confidentiality, Integrity and Availability (CIA) Triad were adapted for the current study as shown in Figure 4.9 and 4.10 respectively.

From Figure 4.9, TAM suggests that the intention to accept cloud computing is determined directly by perceived usefulness, perceived ease of use and perceived trustworthiness. According to TAM, an individuals' intention to use (BIU) technology determines the actual use of the application and attitudes toward use (ATU) of technology affect the intention (Davis, 1989; Davis and Venkatesh, 2004; Venkatesh et al., 2012). Individual factors in demographic and background characteristics are external variables in the study. Perceived usefulness (PU) is assessed by means of the content and benefits of cloud computing to SMEs and the barriers and facilitators to the adoption of cloud computing. The functionality of the cloud computing service described perceived ease of use (PEU) of cloud computing. Perceived trustworthiness (PT) explained the quality of inspiring trust in the use of cloud computing service.

From the CIA Triad (Figure 4.10), the act of not disclosing user's information to unauthorised parties describes confidentiality (CO). Integrity (IN) is assessed by the ability to not accidentally or intentionally changed or destroyed by unauthorised parties. Availability (AV) measures the ability of the service provider to make cloud resources available timeously and in an uninterrupted manner. A measurement of these constructs on the interview and questionnaire are shown in appendix D.

4.11 Conclusion

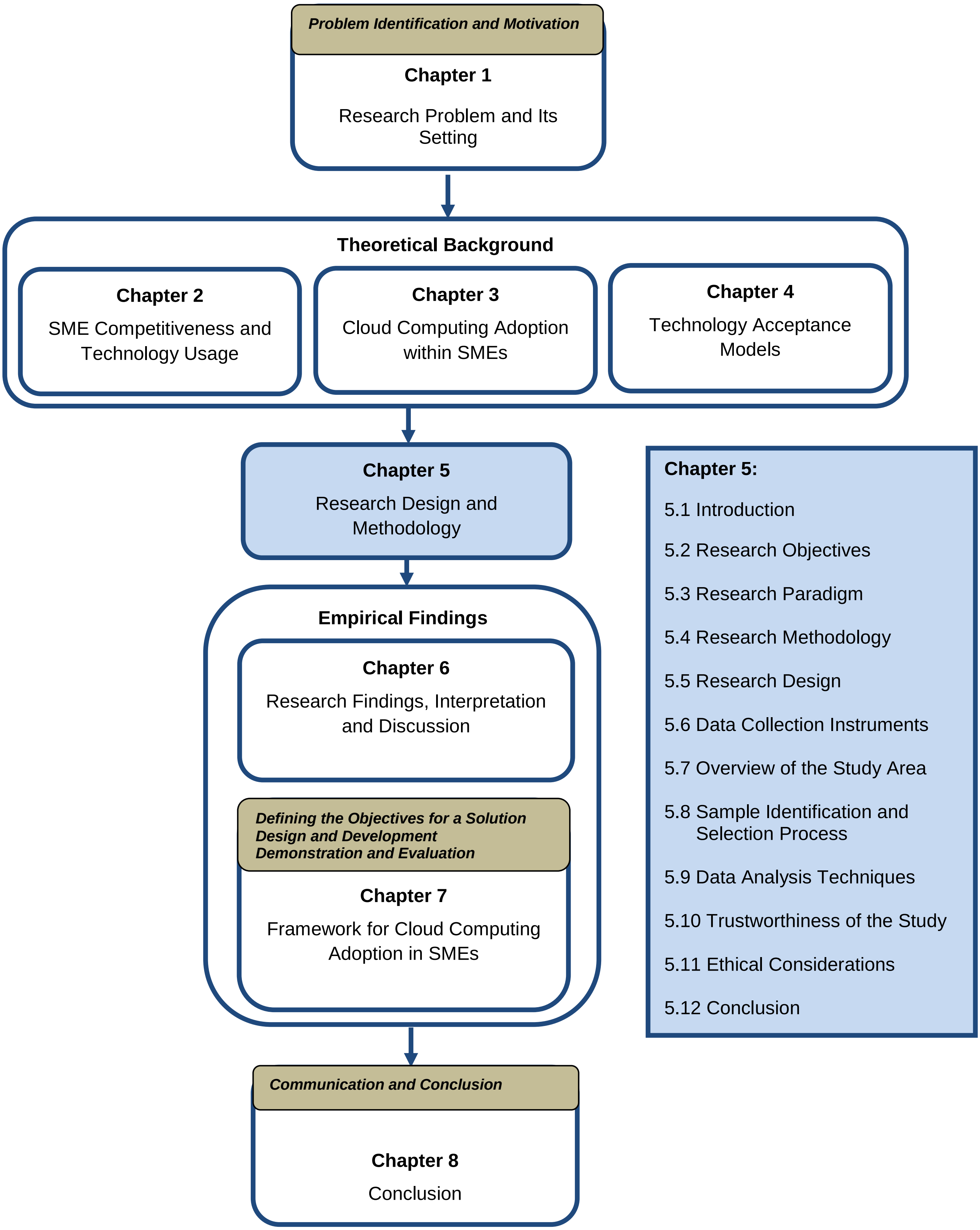
The acceptance of technology by businesses is of paramount importance to researchers. A deeper understanding of the theory behind their adoption will therefore provide a better understanding of the underlying motivators and obstacles that lead to user rejection or acceptance of a particular technology. The study presents research into the factors likely to affect the user acceptance of cloud computing technology using TAM as the underlying theory and in an organizational setting.

The leading technology adoption theories like TAM (Davis, 1986, 1989), TOE framework (Tornatzky & Fleischer, 1990), IDT (Rogers, 1983, 2003), SCT (Bandura, 1986), TPB (Ajzen, 1991), TRA (Ajzen & Fishbein, 1980) and CIA Triad (Steichen, 2010) were critically reviewed in this chapter. It was revealed that these theories were mostly applied in developed countries and that each theory has some limitations.

For TAM, the decision by a firm or individual to adopt a technology is dependent on two factors. Aside from the two factors, there might be other factors that determine the adoption of a particular technology. Hence, TAM can be regarded as a partial model for the adoption of technology. The CIA triad is used for ensuring the security of stored data in systems.

Both TRA and TPB explain the predictors of future behaviour. TRA is however a general model and as such does not specify the beliefs that are operative for a particular behaviour. SCT considers the social nature of human action. IDT explains the factors that affect the decision processing to adopt an innovation. These theories ignored the impact of external factors in technology adoption. Therefore the investigation for external factors and predictors of SME's acceptance of technology for their competiveness is needed.

This chapter is relevant to the problem as knowledge of technology adoption theories and their underlying factors will serve as a theoretical base for successful cloud computing adoption. The next chapter discusses the appropriate research design and methodology to assess the adoption of cloud computing by SMEs.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Chapter 5: Research Design and Methodology

5.1 Introduction

The last three chapters reviewed the relevant literature and thereby set a solid theoretical foundation for this study. It was observed from these chapters that small and medium-sized enterprises (SMEs) in developing countries are faced with numerous challenges which affect their ability to be more competitive in order to compete globally. Additionally, it came to light that the adoption of technology has the potential to offer unprecedented opportunities to help SMEs stay competitive. SMEs have therefore embraced the use of technology to make it a business strategy. However, the rate of adoption is low especially in developing countries as a result of challenges in the adoption process, and many are not able to realize the benefits technology brings. It was also shown that the business environment plays a great role in the competitiveness of enterprises and that SMEs in developing countries operate in unconducive business environments. This affects their ability to be competitive. It was however revealed that SMEs can use technology as an agent to help them become more productive, competitive and relevant. Equally, it was also presented from the literature, that there are underlying motivators and obstacles which lead to user rejection or acceptance of a particular technology. This chapter deals with the research design and methodology used for this study to assess the adoption of cloud computing technology within SMEs.

The success of any given research study depends on the appropriateness of the method followed for the research. Hofstee (2009:109) states that *"careful thought with regard to your method can easily end up saving you an enormous amount of time, effort and frustration"*. The methodology of any given research study provides the different approaches to the research (Fisher, 2007). The research methodology therefore offers an opportunity for the researcher to provide the methods that will be employed to arrive at conclusions in relation to an identified problem. Additionally, it offers an avenue for the researcher to state the reasons for choosing a particular method (Saunders, Lewis, & Thornhill, 2007).

This chapter begins with the research objectives and paradigms underlying the research. This is then followed by the research method and the research design for the study. The data collection instruments used in the study are then presented with justification for the choice of each instrument. The identification of the sample and selection process is also presented and finally, the data analysis method and measures taken to ensure the trustworthiness of the study are described. The ethical considerations taken throughout the study are also described.

5.2 Research Objectives

The primary objective of the study is to propose a framework for cloud computing adoption by SMEs in the Accra-Tema metropolis of Ghana. This primary objective will be achieved through the following secondary objectives:

1. To investigate the adoption of cloud computing to improve information practices for small and medium-sized enterprises in the Accra-Tema metropolis of Ghana.
2. To investigate the required factors for a framework to support cloud computing adoption by small and medium-sized enterprises in the Accra-Tema metropolis of Ghana.
3. To investigate the stumbling blocks for small and medium-sized enterprises when they decide to adopt cloud technology as a competitive tool.

In order to achieve these objectives, there is the need to identify appropriate method(s). The sections which follow will therefore discuss the research methodologies adopted for this study.

5.3 Research Paradigm

A paradigm sometimes called a philosophy is, according to Taylor, Kermode and Roberts (2007:5), “a broad view or perspective of something”. In addition, Weaver and Olson’s (2006:460) explanation of a paradigm indicates the effect of paradigm on research by concluding that “paradigms are patterns of beliefs and practices that regulate inquiry within a discipline by providing lenses, frames and processes through which investigation is accomplished”. Consequently, for a better structure of inquiry and methodological adoptions, there is the need for a probe of the paradigm used for this study before any discussion of particular methodologies for this study.

Easterby-Smith, Thorpe and Lowe (2002) provide reasons for using paradigms in a research study. Firstly, an understanding of a research paradigm can help clarify research design issues, like the type of evidence required and the ways to gather and interpret the evidence after collection. Secondly, it will be beneficial to researchers as it can help them recognize the best designs for a particular research study and the limitations to that approach. This is therefore a clear indication that a researcher should be aware of and have a better understanding of the differences among the key research paradigms.

Gephart (1999) classified and categorized research paradigms into three: positivism, interpretivism and critical postmodernism. Even though these paradigms have clear philosophical viewpoints, it is sometimes difficult for researchers to align themselves with one belief since it is possible to accept the philosophical idea of one paradigm and collect data and generalize the findings using another paradigm. In some instances a researcher from one philosophical standpoint may develop ideas which fit perfectly to those of another view (Easterby-Smith et al., 2002). This discrepancy has brought about a situation where researchers pay no attention to expressing their views in a particular philosophical standpoint. Furthermore, mixtures of paradigms have resulted in pragmatism (Tashakkori & Teddlie, 1998). Below is a further explanation of the abovementioned paradigms.

5.3.1 Positivism

The positivists assume that the social world is external and should be determined through objective means rather than through subjective reflections and it depends on the researcher and the instrument used for the research (Myers, 1997). Oates (2008:287) summarized the positivist viewpoint as follows:

1. *The world exists independently of humans*: There is a physical and social world existing “out there” not just in our minds which can be studied, captured and measured.

24. *Measurement and modeling*: The researcher sees this world through observations and measurements and develops models of how it operates.

25. *Objectivity*: The researcher is neutral, objective and an unbiased observer. Hence, facts about the world can be learned regardless of the researcher’s personal values and beliefs.

26. *Hypothesis testing*: Empirical testing or theories and hypotheses result in the approval or rejection of the research objectives.

27. *Quantitative data analysis*: There is mostly a strong liking for mathematical modeling and proofs of statistical analysis. The use of mathematics offers a logical and objective means of analyzing observations and results.

28. *Universal laws*: Researchers look for generalizations, universal laws, patterns or undisputable facts that can be proved to be true irrespective of the researcher and the time.

Although this standpoint produces effective outcomes, it was unsuccessful in bringing into perspective the human aspect. According to Oates (2008) the positivist standpoint is less suited to studying the social world such as the world of people, organization of group structures people build, the culture they develop and meaning they assign to things. As a result, this paradigm may present less value to this study.

5.3.2 Critical Postmodernism

The critical postmodernism paradigm is a mixture of two different ideas, that is, critical theory and postmodernism (Gephart, 1999). Although the two emerged from different traditions, they are broad instructions for intellectual movements rather than specific theories. Critical postmodernism is less radical in its approach and attracts several fields of studies that often go beyond radical postmodernism. This paradigm is a force of liberation that engages an on-going conflict with the powers of oppression and seeks to bring about educational reform (Reves & Hedberg, 2003:33).

Critical researchers believe reality is constructed, produced and reproduced by people (Myers, 2009). Although people can decide to change their social and economic situation, the critical researcher believes their ability to do this is inhibited by socio-political factors (Myers, 1997). According to Gephart (1999) critical postmodernism seeks to attain social transformation to displace the existing structures of power and domination. Therefore, this paradigm has little relevance to this study.

5.3.3 Interpretivism

Interpretive researchers believe that knowledge of reality is socially constructed. Thus, interpretivism assumes that reality consists of people's subjective experiences of the external world, and thus reality is given or socially constructed. According to Kaplan and Maxwell (1994) both dependent and independent variables in interpretive research are not predefined but rather concentrate entirely on the complexity of human sense-making as the situation emerges. The intreprevist paradigm explains a phenomena using what meaning people assign to that phenomena (Deetz 1996).

Interpretive research in a technological field which is "*aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context*" (Walsham 1993:4). According to Burrell and Morgan (1979) interpretivism is not a single paradigm, but rather a collection of diverse paradigms.

Additionally, Burrell and Morgan (1979:22) made available a sociological paradigm to help better explain the position and nature of interpretive philosophy. Figure 5.1 below is the graphical representation of the sociological paradigm.

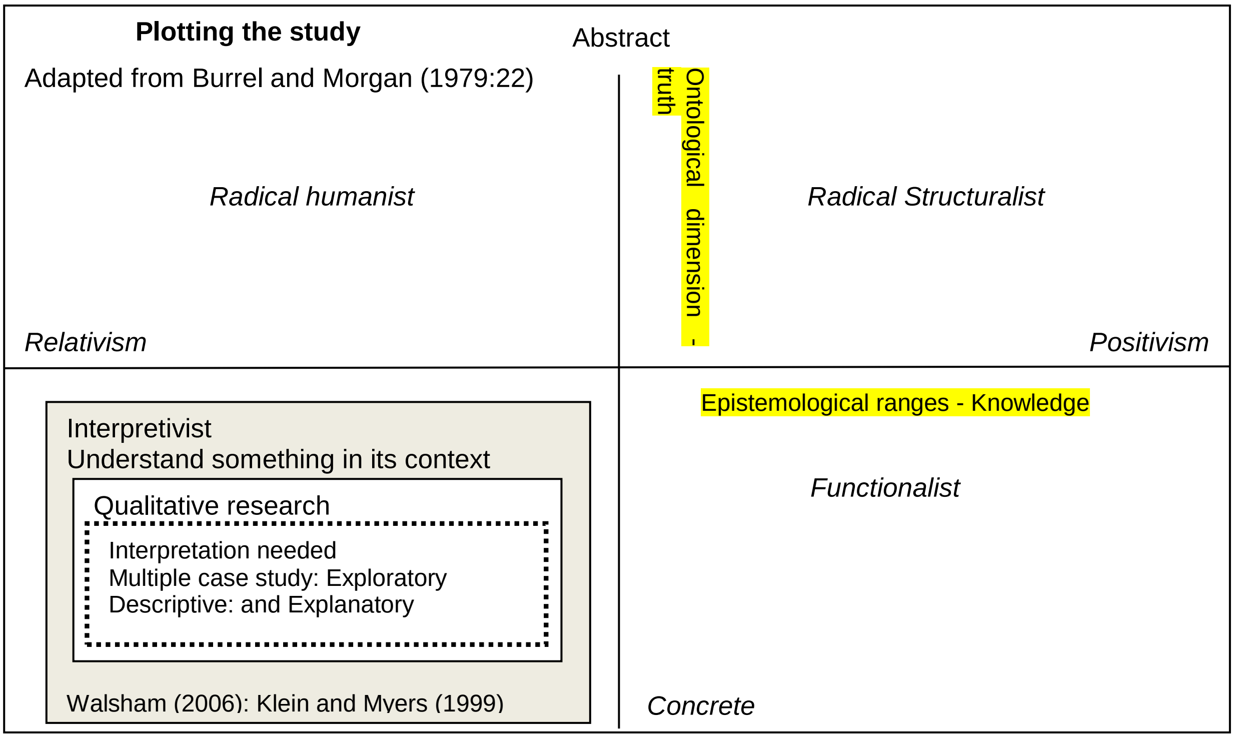


Figure 5.1: Interpretive Paradigm (Source: Burrell & Morgan, 1979)

Burrell and Morgan (1979) propose four research paradigms: functionalist, interpretivist, radical humanist and radical structuralist. According to Burrell and Morgan (1979:22) whereas the functionalist paradigm assumes the world consists of concrete artefacts and relationships that can be identified, studied and measured through natural science from an objective standpoint, the interpretivist paradigm is interested in understanding the world as it is. The radical humanist paradigm also concerns itself with the social world from an ideographic perspective, similar to the interpretivist philosophy, but focuses more on the elimination of the limitation associated with existing social structures. The radical structuralist paradigm, on the other hand, concentrates on structural relationships within a social world and offers reasons for the basic interrelationships within the context of social formations. This paradigm is also concerned with radical change.

5.3.4 Pragmatism

Pragmatism assumes that "*the worth of a proposition or theory is to be judged by the consequences of accepting the proposition or theory*" (Kelder, Marshall, & Andrew, 2005:4). As a result, theories and ideas are considered beneficial tools for the purpose of increasing our ability to expound and utilize phenomena (Levy & Hirschheim, 2012). The pragmatist sees truth through inquiry into the relevance of propositions, models and theories with the aim of helping people to better cope with the world or develop better situations for themselves (Johnson & Onwuegbuzie, 2004). The pragmatist researcher uses methods that are appropriate and utilizes results that makes contributions within the value system. Pragmatism assumes knowledge is not absolute, created in social environment and situated in history (Kelder et al., 2005). Hence, theory is only relevant after it has been used successfully in a particular context and within the period within which it is established to be useful (Levy & Hirschheim, 2012).

5.3.5 Paradigm Adopted for this Study

This study will be grounded in the pragmatic paradigm for a number of reasons. The study aims to develop a framework and will use the design science approach. Since pragmatism focuses on practical applications, it resonates well with the aims of design science. Additionally, the assertion that theory and decisions are not absolute and only relevant within the period of its applicability in a particular context permits on-going enquiry and continuity in the improvement of the developed artefact (Johnson & Onwuegbuzie, 2004; Kelder et al., 2005). Pragmatism adopts a pluralistic approach by rejecting any inappropriate methods and thereby allowing the researcher to choose from a mix of methodologies to help solve the problem under investigation (Johnson & Onwuegbuzie, 2004; Levy & Hirschheim, 2012).

In the context of this study, some factors are of particular significance in relation to the paradigm. Firstly, pragmatism views research as value-oriented (Johnson & Onwuegbuzie, 2004). Secondly, it seeks to develop a visible product and validate the purpose of the research (Kelder *et al.,* 2005). Finally, there is the need for evaluating ethics of decisions, actions and the research process (Kelder *et al.,* 2005). This is to ensure that the research is conducted in the right way and makes a difference. Additionally, research based on qualitative surveys via interviews is identified by Kelder *et al*. (2005) as an appropriate research strategy for a pragmatic philosophy. The aim of this study is to develop a framework that will be beneficial to the researcher and participants alike. From the pragmatist viewpoint, the framework isn't proven but constructed from the researchers' and participants' experiences during the study (Kelder *et al.,* 2005). These conditions of pragmatism are in line with the objectives of this study.

The use of multiple research paradigms is gradually becoming popular (Mingers, 2001; Orlikowski & Baroudi, 1991; Patterson & Williams, 1998), as this leads to better and more reliable research findings as well as creativity (Mingers, 2003; Saunders, 2007). The socio-technical nature of Information Systems (IS) research makes this assertion true as both the domain and research processes are complex and multi-dimensional (Gregor, 2006; Mingers, 2003)

As a result, the study will employ another paradigm, interpretivism, to the data collected from the interview. The interview will focus on gaining better insight into the operations of SMEs in the Ghanaian context by assuming an empathetic position and not imposing an understanding and perceptions on the situation. Interpretivism will be used to interpret the findings and results to gain an understanding of how cloud computing technology adoption can influence their business operation positively or negatively in their quest to attain competitive advantage.

5.4 Research Methodology

Research methodology is the approach to the research process and includes a number of methods (Collis & Hussey, 2009). The choice of method should be reflective of the aims of the research, availability of time and resources, paradigm and approach (Saunders *et al.,* 2009). As a result, research can be divided into five main categories (Thomas, 2004; Saunders *et al.,* 2009):

1. *Evaluation research:* Seeks to give a systematic account of events in cases were changes are expected;

2. *Theoretical and pure research**:*** Is a research deign where there is the expansion of knowledge with the aim of helping to solve the research problem;

3. *Applied and policy research:* Policymakers use this form of research to make informed decisions. This form of research is both theoretical and practical;

4. *Critical and feminist research:* This form of research is often critical of basic hypotheses and conventional research strategies. Feminists supports research that contributes towards the advancement of women; and

5. *Qualitative and quantitative research:* This is the use of numerical data in quantitative research and the use of experiences or verbal data in qualitative research.

Even though there is often a preference for positivist research in information systems (IS) (Harvey & Myers, 1995), the current study adopts the use of qualitative research method because it can help answer the research questions in this study. This is therefore discussed further in the subsection below.

5.4.1 Qualitative Research

Qualitative research involves the collection of a variety of materials that describe routine and problematic instances and meanings in individual’s lives. It employs the use of descriptive and interpretive methods of gathering and analyzing data (Marshall & Rossman, 2010; Creswell, 2003). Qualitative research attempts to make meaning or interpret issues through the meanings people assign to them (Denzin & Lincoln, 2003). Thus, it explores and discovers issues about the problem, because very little is known about the problem (Domegan & Fleming, 2007). IS research that develops knowledge through social construction such as interviews, and other interactions is considered interpretivist research (Kaplan, Truex & Wastell, 2004).

5.4.2 Rationale for a Qualitative Study

The philosophical foundation in interpretive research is that there is the need for interpretation in order to understand a phenomenon (Creswell, 2003). In IS research, interpretive methods aim at *"producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context"* (Walsham, 1993: 4-5). The use of interpretive research has become a popular alternative to the more traditional positivist and critical theory strategies (Kaplan *et al.,* 2004). It is very difficult to model or understand a phenomenon using traditional positivist approaches (Kaplan *et al.,* 2004), especially due to the complex relationship that exists between people, technology, and organizational influences within an IS domain.

As a result of the above reasons, qualitative research was deemed appropriate for the current study. Moreover, Creswell (2007) concurs to the use of qualitative research methodologies for research involving organizations and small communities.

Some of the approaches that can be employed in a qualitative research process are:

1. *Grounded theory:* The empirical data is usually analyzed to allow for the construction or verification of a theory from the data (Creswell, 2003).

2. *Content analysis:* In this approach, themes, patterns and ideas are identified from secondary sources (Leedy & Ormrod, 2009).

3. *Ethnography:* This approach involves the gathering of information through observation of items in the study area for a period of time (Creswell, 2003).

4. *Action research:* This is a situation where a researcher or group of researchers undertake research with the intention of improving the quality of the organization under study (Thomas, 2004).

5. *Phenomenology:* This approach involves the identification of a phenomenon through how it is seen by people under study (Leedy & Ormrod, 2009).

6. *Case study:* This is an in-depth exploration of the subjects of the study in their natural settings (Creswell, 2003).

For the purpose of this study, a case study approach was adopted to allow for an in-depth exploration of the usage of cloud computing by SMEs in their natural settings, specifically the Accra-Tema metropolis of Ghana. The case study strategy is further discussed in the following subsection.

5.4.3 Case Study

Case studies are an empirical technique for exploring a phenomenon within its natural environment, especially when there is no clearly defined boundary between the phenomenon and the context (Yin, 2003). It provides a means for investigating situations in their natural settings where the researcher has no or little control over events as they happen.

Benbasat, Goldstein and Mead (1987:370) explained why the use of case study research is appropriate for IS research: *"First, the researcher can study information systems in a natural setting, learn about state of the art and generate theories from practice. Second, the case method allows the researcher to answer "how" and "why" questions, that is, to understand the nature and complexity of the processes taking place….Third, a case approach is an appropriate way to research an area in which few previous studies have been carried out."*

In relation to this study, all three requirements put forward by Benbasat et al. (1987:370) were addressed. Firstly, cloud computing usage is assessed within the context of SMEs in which they can be used. This allows for contextual insight into issues relating to cloud computing effect on businesses. Secondly, the *how* and *what* questions are addressed in the primary and secondary research questions of this study. Finally, the researcher has no known knowledge of any research conducted in Ghana that seeks to find out how cloud computing usage can make SMEs more competitive.

Case study research can either be single or multiple case studies (Yin, 2009), defined as:

1. *Single case study:* This type of study uses a single unit of analysis to test for a theory proposition or to imply a unique case.

2. *Multiple case study:* It utilizes several units of analysis thereby allowing for the gathering of large amounts of data from several sources.

As a result of the collection of data from a single unit of analysis, single case study research design produces a better understanding of the phenomenon under investigation (Yin, 2009).

As a result of these reasons, the current study adopts a single case study approach to investigate how SMEs in the Accra-Tema metropolis of Ghana can adopt and use cloud computing. The next section discusses the research design adopted for this study and the reason for its implementation in this study.

5.5 Research Design

Research design is the act of organizing collected data in such a way that will help achieve the research aims (Easterby-Smith *et al.,* 2002). According to McMillan and Schumacher (2001), research design is a plan for choosing subjects, research sites and procedures for collecting data to answer the research question(s). It is therefore imperative that the researcher chooses a design that is likely to achieve the aims and objectives of the study.

According to Tharenou, Donohue and Cooper (2007) it is ideal that the researcher starts with the question and follows this with an appropriate research design (Tharenou *et al.,* 2007). The design allows the researcher, among other things, to come up with a general summary for the data collection and analysis of a study (Lacobucci & Churchill, 2009).

The current study seeks to investigate how a framework can assist SMEs in their use of cloud computing to make them more competitive in the Accra-Tema metropolis of Ghana. In order to answer the problem, the researcher used the design science strategy and followed the specific guidelines of this strategy throughout. This was however informed by different data collection methods. The sections that follow provide a description of design science research strategy, framework, process and relevance.

5.5.1 Design Science Strategy

Design science is a problem solving approach to doing research and seeks to create and evaluate an information and communication technology (ICT) artefact to solve an identified organizational problem (Hevner, March, Park & Ram, 2004). The problem according to Hevner and Chatterjee (2010:11) is "*the ill-defined environmental contexts, creativity and teamwork to yield effective solutions*". Hevner, *et al.* (2004) further added that design science research seeks to create innovations that define ideas and products through which the analysis, implementation and use of the information system can be achieved. Humans create the artefact in design science research for practical purposes and March and Smith (1995) identified four types of artefacts: concepts, instantiations, methods and models.

For this research study, the artefact will be a proposed framework. According to Geerts (2011), this brings to light two critical characteristics of design science artefacts, namely: relevance and novelty. The artefact has to solve an identified problem which is, relevant.

Secondly, Hevner *et al.* (2004) distinguished design science research from other research as it must try to solve a problem in a unique and innovative manner or a solved problem in a more efficient manner.

5.5.2 Design Science Research Framework

The design science research framework was proposed by Hevner, *et al.* (2004) for the building and evaluation of information technology (IT) artefacts. It aims to develop practical knowledge for the design and implementation of solutions in a socio-technical system where Information Systems artefacts are a critical means for achieving the desired outcomes of an intervention. It was therefore referred to as the Information Systems Research Framework. Figure 5.2 shows the Information Systems Research Framework.

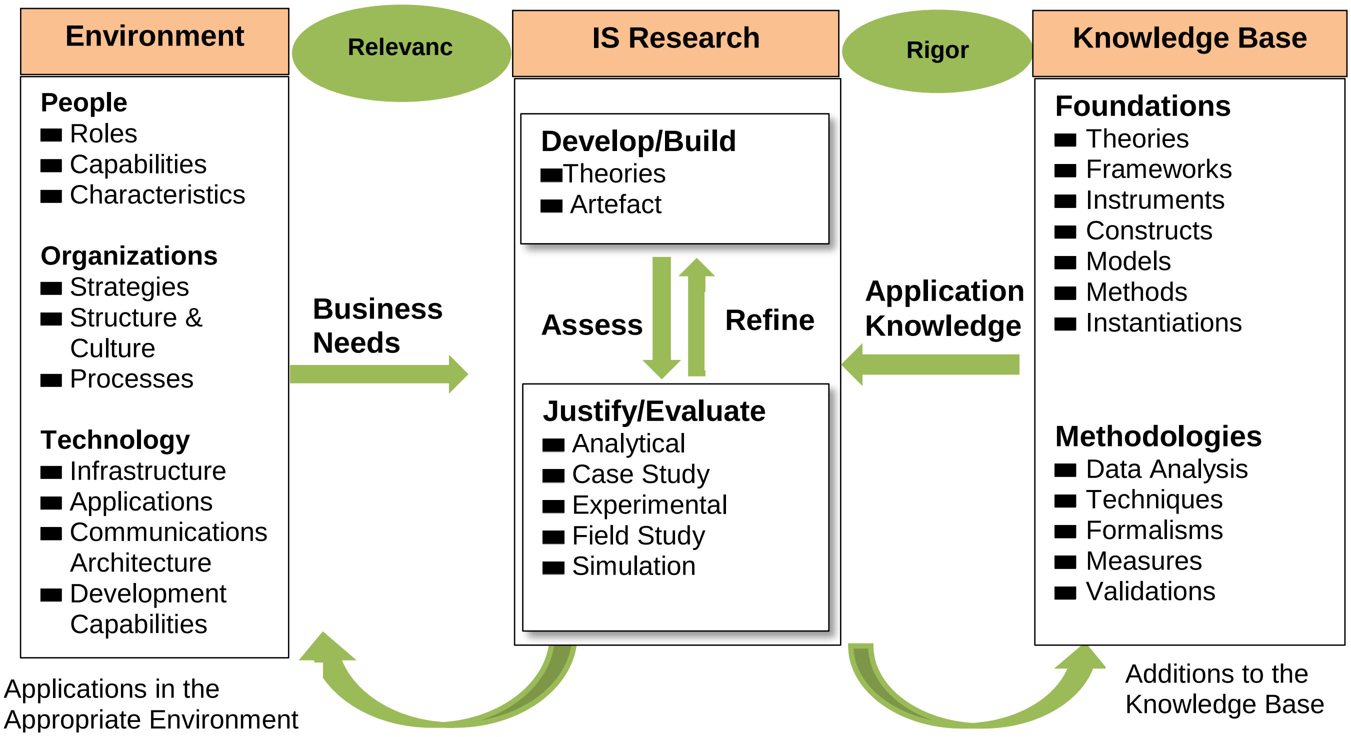


Figure 5.2: Information Systems Research Framework (Source: Hevner et al., 2004)

Hevner (2007) extended the above framework by incorporating three inherent cycles existing in design science research as shown in figure 5.3.

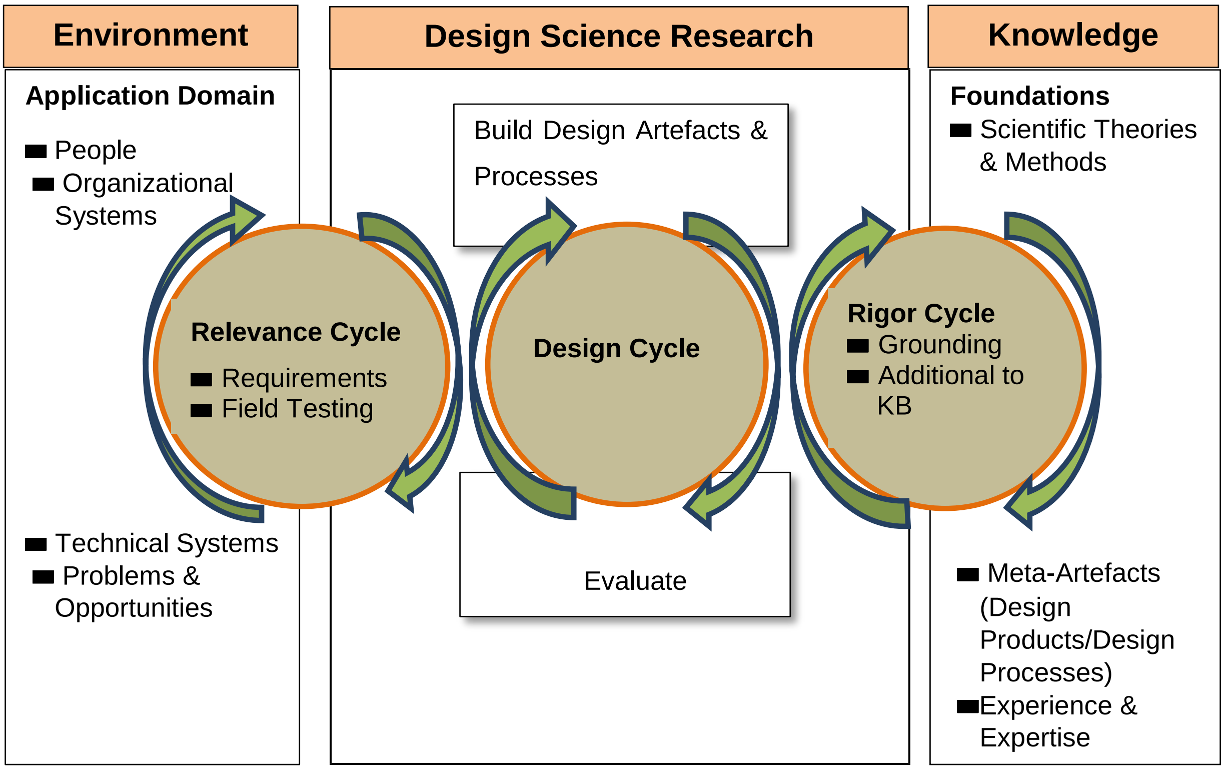


Figure 5.3 Design Science Research Cycles (Source: Hevner, 2007)

The relevance cycle links the area under study to the design science activities. The knowledge base of scientific activities that informed the research is connected to the design science activities at the rigor cycle stage. The central design cycle iterates between the core activities of building and evaluating the developed design artefacts and methods of the research. According to Hevner (2007), every design science research must undergo all three cycles of activities.

5.5.3 Design Science Process

A conceptual process and model for carrying out a design science research was proposed by Peffer, Tuunanen, Rothenberger and Chatterjee (2007). This design science research process (DSRP) for undertaking design science research was in line with earlier literature (Hevner *et al.* 2004; Hevner 2007; Ellis and Levi 2010) and consists of six stages: Problem identification and motivation, objectives for a solution, design and development, demonstration, evaluation, and communication. Figure 5.4 below shows the conceptual process for embarking on design science research.

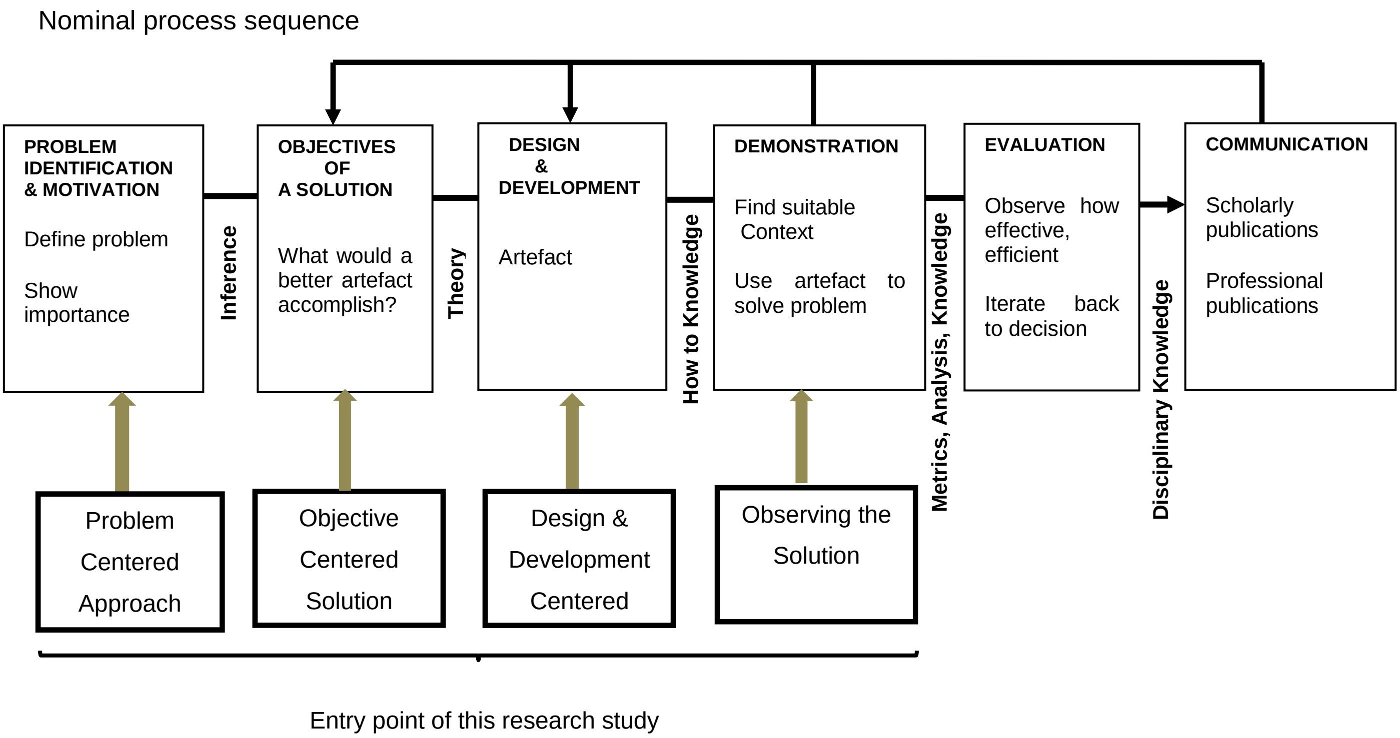


Figure 5.4: Design Science Research Process (DSRP) Model (Source: Peffers et al., 2007)

The DSRP proposed by Peffers *et al.* (2007) was adapted for this research study and the different stages are shown in figure 5.5 below. Arrows were used to indicate iterations of the design science research process between the steps.

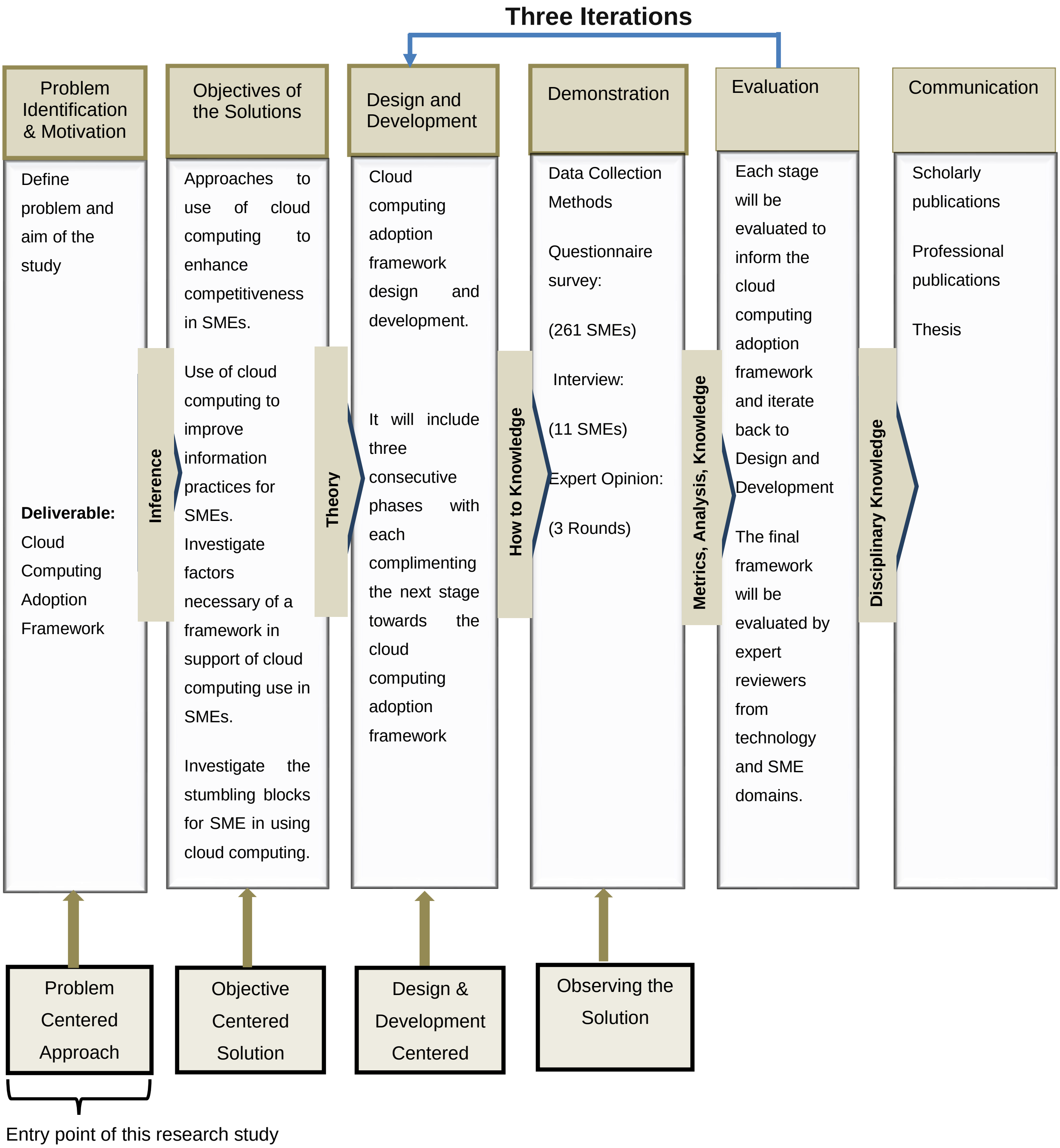


Figure 5.5: Design Science Research Process for this Research Study (Source: Adapted from Peffers et al, 2007)

The sections that follow explain the six design science research processes as applied in this study.

5.5.3.1 Problem Identification and Motivation

Problem identification and motivation of research involves undertaking a critical review of all related literature to identify the problem, motivate the research, and to justify a solution to the problem. The justification of the value of a solution to the identified problem has two effecst on the research: it encourages the people undertaking the research to push for a solution and to accept the findings of the research and also it gives an in depth understanding of the reasoning behind the researcher's understanding of the problem (Peffers *et al*. 2007). This has been done in the preceding Introduction and Literature chapters.

5.5.3.2 Objectives of a Solution

After the research problem has been identified and well-motivated, the objectives of a solution to the problem are then deduced from the problem. With the specific problem identified and research well motivated, the objectives of a solution can then be deduced from the problem definition (Peffers *et al*. 2007). The current study aims to develop an artefact to support SMEs to adopt cloud computing.

5.5.3.3 Design and Development

A solution for the problem is then designed, such as developing hypotheses (technological rules) and artefacts (Hevner, *et al*. 2004). This stage also involves presenting the requirements of the solution, determining the functionality and architecture of the artefact, and then developing the actual artefact and processes (Peffers *et al*. 2007). This is done in Chapter 7, where the framework output of this study is presented and described.

5.5.3.4 Demonstration

This stage of the research involves the demonstration of the ability of the hypotheses and the developed artefact to solve the problem. It includes their use in analysis, experimentation, simulation, testing, study or other relevant activities to be examined by experts (Hevner, *et al*. 2004). The framework developed for this study, was examined by experts in order to refine the final output.

5.5.3.5 Evaluation

This stage involves the rigorous demonstration of the utility, quality and efficiency of a design artefact through the use of well-executed evaluation methods (Hevner, *et al.,* 2004). The evaluation of the designed solution is then done by experts from technology and SME development domains using methodologies in the knowledge base (see Table 5.1). The process of evaluation by experts is known as expert review, since their recommendations will affect the evaluation results (Jacobsen, Hertzum & John, 1998). Using their experience and knowledge, experts review heuristically the artefact through the comparison of the objectives of the solution to the actual results after using the artefact in the demonstration. Finally, the evaluation stage ends with the researcher iterating back to the design and development stage to incorporate expert recommendations in the final artefact. Three such iterations were completed in this study in order to produce the final framework.

Table 5.1: Design Evaluation Methods (Source: Adapted from Hevner, et al. 2004)

		Expert Utility Review: Heuristic evaluation of the artefact's utility leveraging the evaluators' experience and knowledge
1. Observational	**Field Study:** Study artefact in depth in business environment	×
	Field Study: Monitor use of artefact in multiple projects	×
2. Analytical	**Static Analysis:** Examine structure of artefact for static qualities (e.g. complexity)	✓
	Architecture Analysis: Study fit of artefact into technical IS architecture	✓
	Optimization: Demonstrate inherent optimal properties of artifact or provide optimality bounds on artifact behaviour	✓
	Dynamic Analysis: Study artefact in use for dynamic qualities (e.g. performance)	✓
3. Experimental	**Controlled Experiment:** Study artefact in controlled environment for qualities (e.g. usability)	✓
	Simulation: Execute artefact with artificial data	✓
4. Testing	**Functional (Black Box) Testing:** Execute artefact interfaces to discover failures and identify defects	✓
	Structural (White Box) Testing: Perform coverage testing of some metric (e.g. execution paths) in the artefact implementation	✓
5. Descriptive	**Informed Argument:** Use information from the knowledge base (e.g. relevant research) to build a convincing argument for the artefact's utility	✓
	Scenarios: Construct detailed scenarios around the artefact to demonstrate its utility	✓

5.5.3.6 Communication

This stage of the research presents the problem and its importance, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant bodies (Peffers *et al.* 2007). This is achieved through peer reviewed conference papers and journal articles from which rapid feedback will ensure credibility of both the results and research methodology. Three papers have been produced from this study, which are currently under review.

Additionally, this research process was guided by Hevner, et al. (2004) who recommended the use of seven guidelines when carrying out research using design science. These seven guidelines are widely cited in design science research and thus relevant to this study. They serve as underlining steps in carrying out design science research. However, these guidelines are not mandatory steps and its use depends on the researcher who decides when and how to use each of the seven guidelines (Hevner, *et al.,* 2004). The guidelines, their description and how each guideline was applied in this research study is provided in table 5.2.

Table 5.2: Design Science Research Guidelines (Source: Adapted from Hevner, March, Park & Ram, 2004)

Guideline	Description	Application to this Study
Guideline 1: **Design as an Artefact**	Design-science research must result in the creation of a practical artefact in the form of constructs, models, methods or instantiations.	The study explored how SMEs can be made more competitive through the use of cloud computing. The final artefact is a framework that can assist SMEs to use cloud computing technology to make them more competitive.
Guideline 2: **Problem Relevance**	Design science research aims to build up technology-based solutions to inherent and relevant business problems.	The problem recognized in the study refers to the lack of competition amongst SMEs and how the use of cloud computing can make them more competitive.
Guideline 3: **Design Evaluation**	The design artefact has to be thoroughly evaluated through well-executed methods in order to yield utility, quality and usefulness.	The framework was evaluated by expert reviewers from technology and SME development domains. Their recommendations were incorporated into the final artefact.
Guideline 4: **Research Contributions**	Design science research needs to offer new and acceptable contributions in the fields of design artefact, design foundations and/or design methodologies.	The design artefact and framework, is expected to offer a valuable insight into how to use cloud computing technology appropriately in order to make small businesses more competitive.
Guideline 5: **Research Rigor**	Design science research employs rigorous methods in the construction and evaluation of the design artefact to ensure coherence and consistency.	A questionnaire and interview guide was constructed based on themes derived from existing literature, and questionnaires found in literature which have been validated previously will be used. This facilitates reliability and efficiency. Expert reviews were conducted for the purpose of assessing and validating the developed framework.
Guideline 6: **Design as a Search Process**	The creation of an effective artefact requires consideration of the problem environment and mechanisms that can find an effective solution.	The research questions were answered using a combination of formal content analysis of literature, existing theories, methodologies and previous studies. These methods ensured that a variety of sources are selected which led to legitimate and relevant results.
Guideline 7: **Communication of Research**	Design-science research must be communicated effectively both to technology-oriented as well as	The study provided a framework to SMEs and governmental SME development agencies to explore the

	management-oriented audiences.	use of cloud computing by SMEs to make them more competitive. The framework has been published in an accredited journal and the results made available in the problem environment.

The proper application of these seven guidelines in design science research according to Hevner et al. (2004) will result in valid conclusions in terms of producing a relevant framework.

5.5.4 Relevance of Design Science Research to This Study

Design science research concentrates on creation and aims to change existing situations into preferred ones (Simon, 1996). It tackles identified problems in IS (Rittle & Webber, 1984) and hence is a problem solving technique. There are compelling arguments to accept the inability of SMEs in developing countries such as Ghana to be competitive as an identified problem.

As mentioned above, the study will adopt the design science research process and follow the seven guidelines to help develop an effective framework that will help SMEs attain competitive advantage. The process was however informed by different data collection instruments. The next section therefore discusses the different data collection instruments used and their implementation in the current study.

5.6 Data Collection Instruments

Several instruments for data collection exist but the best instrument is the type that will be able to address the various research questions that have been framed (Kothari, 2004). This study employed more than one instrument for the collection of data. Using more than one instrument in a research study allows the researcher to view the situation from different perspectives (Oates, 2008). Additionally, the use of more than one instrument enables the outcomes to be substantiated or questioned through comparison with other available methods.

To answer the research questions, data was collected from primary sources and secondary sources. According to Collis and Hussey (2009), primary sources of data are original in nature and are obtained from sources such as the experiments, questionnaires and interviews. This means that the data is unpublished and obtained directly from respondents. On the other hand, secondary sources of data come from published sources such as journals, publications and records from databases (Collis & Hussey, 2009). The study employed web-based questionnaires, interviews, and expert opinion as primary sources of data, and literature review of published studies as secondary sources of data. Figure 5.6 shows the data collection process used for this study.

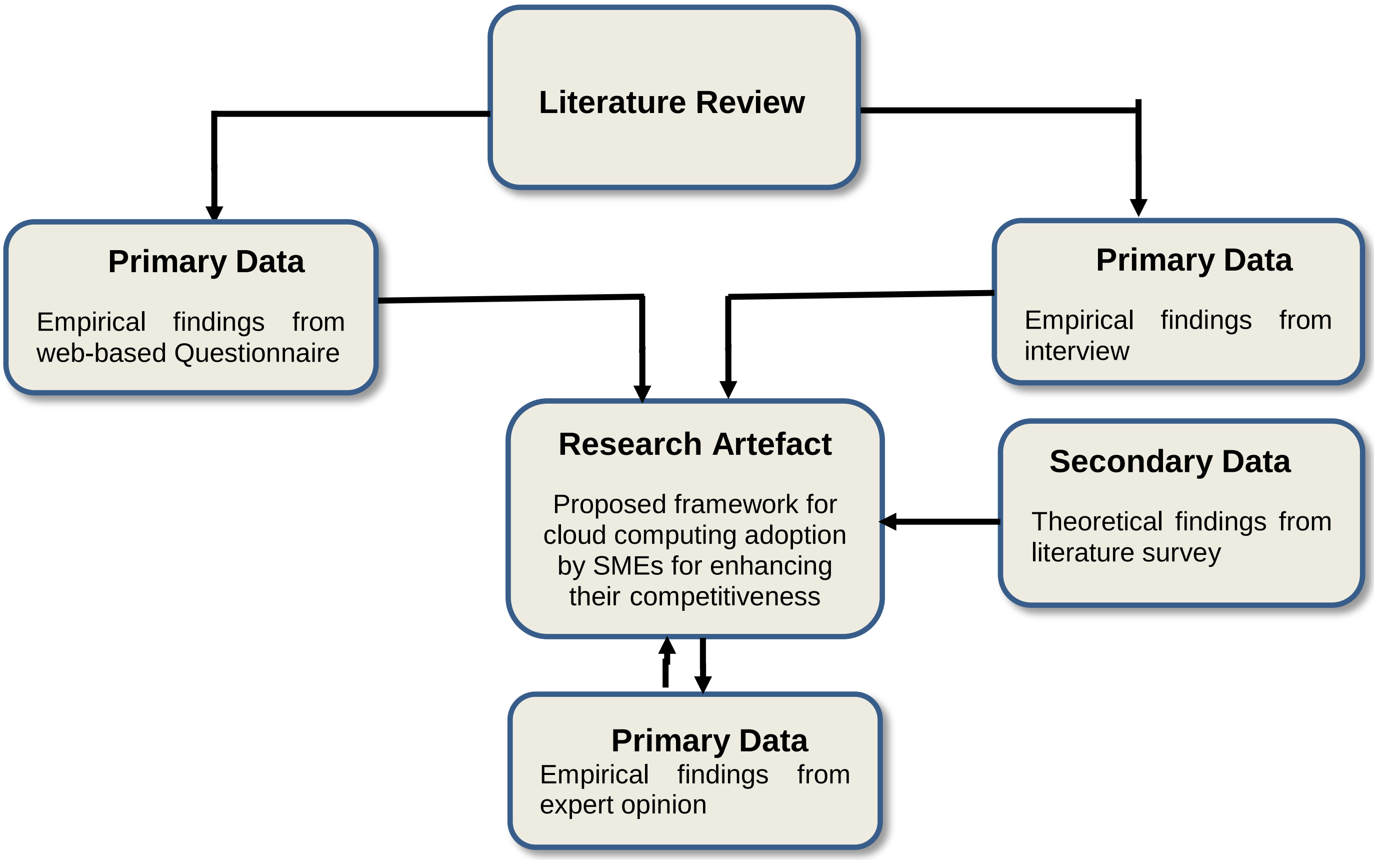


Figure 5.6: Data Collection Process for the Study (Source: Own Creation)

From figure 5.6, the reviewed literature was used as the theoretical basis for the study. The development of the initial cloud computing adoption framework, interview guide and the web-based questionnaire were influenced by this theoretical base. The interview and web-based questionnaire were used to collect the empirical data. The recommendations from experts in their assessment of the initial framework, together with the empirical findings from the primary data formed the basis of the proposed cloud computing adoption framework for SMEs. The proposed framework, which is the research artefact, was formulated after careful analysis and incorporation of recommendations from experts and empirical findings which were combined with the secondary data.

This research artefact, a framework for cloud computing adoption among SMEs in Ghana, is described in chapter 7. The framework was then further validated using expert reviews. The primary and secondary data collection instruments used for this study are explained in the following sections.

5.6.1 Primary Data Collection Instruments

The primary sources of data for this study are a web-based questionnaire, interview and expert review.

5.6.1.1 Web-based Questionnaires

A questionnaire is a form or set of forms containing a number of questions in a definite order (Kothari, 2004), and are designed to address a statistically significant number of subjects. Questionnaires have the advantage of reaching a wider audience and Collis and Hussey (2009) argue that web-based questionnaires have the ability to cover a wider geographical area and give a higher degree of freedom compared to paper-based questionnaires and interviews.

However, the use of web-based questionnaires as a data collection instrument is characterised by a risk of non-response, bias and wrongful interpretation of questions. Additionally, there is the reluctance of respondents to answer as a result of questionnaire fatigue thereby affecting the effectiveness of this data collection instrument (Collis & Hussey, 2009). It is therefore imperative that questions developed incorporate the use of a relevant response format. As a result, the questionnaire was pre-tested to ensure its suitability. The design of the questions and its content was guided by a thorough review of published literature. For statistical consistency, advice was sought from the Statistics Department of the University of Fort Hare (UFH) to help ensure the validity of items in the questionnaire.

The questions in the web-based questionnaire for this study were both close-ended and open-ended to elicit information from respondents. Whereas close-ended questions restrict respondents on the responses provided to questions in the questionnaire, in open-ended questions the respondent is able to freely answer the question (Babbie, 2008). The questionnaire for the study consisted of five sections. The first four sections (see appendix B) cover the details of the responding SME, their experience with the use of Internet services, familiarity with cloud-based applications and experiences with the use of cloud computing. Section E consists of questions about cloud computing adoption decisions, adoption concerns, cloud adoption motivators and issues relating the management of information. The responses gathered from the sets of options are analysed for themes and keywords. The findings of the questionnaire are described and discussed in the next chapter.

5.6.1.2 Interviews

Interviews are methods of soliciting information through the use of oral or verbal conversation between a researcher and the sample (Yin. 2009). Interviews can help researchers pursue specific problems that may result in focused and constructive suggestions (Shneiderman & Plaisant, 2005). According to Jacobsen (2002) interviews are the best way to confront a face-to-face situation. Personal attendance brings about a more confidential atmosphere and allows for a more natural way of interrogating. It also makes it easier to detect from gesticulations where follow-up questions can offer the opportunity to go in-depth on certain issues of concern and where the interview subject feels uncomfortable. However, interviews have the disadvantage of usually being time consuming and resource demanding as the amount of data collected is very high and usually unstructured.

Based on the need and research design, interviews can either be focus-groups, structured, semi-structured or unstructured interviews. These are defined as follows:

1. *Focus-Group Interviews*: This type of interview is the least structured as a result of the difficulty in bringing structure in a group. However this style of interview results in a rich sample of data. Individuals in a group are able to develop and express ideas they would not have thought of on their own (Preece, Rogers & Sharp, 2002). This type of interview follows different sets of individual interviews and seeks to further explore the general nature of the observations made from the different individual interviews (Shneiderman & Plaisant, 2005).

2. *Structured Interviews*: With this type of interview, the interviewer adopts a set of predetermined questions which are mostly short and clearly worded. These questions are usually closed-ended and therefore demand precise answers in the form of set options read out or supplied on paper. As structured interview is easy to organize, and easy to standardize due to the fact that the same questions are asked to all subjects. This type of interview is mostly employed when the goals of the study are clearly understood and specific questions can be identified (Preece *et al.,* 2002).

3. *Unstructured Interviews*: This type of interview allows the interviewer to ask open-ended questions with the subject having the opportunity to freely offer their opinion. It requires the careful attention of the interview participants since it is like a discussion on an identified issue. The scope of the interview is not predetermined but rather determined by the interview participants. This make it difficult to standardize the interview since each interview takes on its own format (Preece *et al.,* 2002). It is strenuous when analyzing the gathered data.

4. *Semi-structured Interviews*: This type of interview involves some aspect of structured and unstructured interviews and as a result, employs both open-

ended and closed-ended questions during interview sessions. The interview begins as structured by stating the core question, and the session is subsequently controlled by asking certain probing questions that requires the subject to elaborate or provide more information. According to Creswell (2007) this interview style offers a framework that guides the researcher, allows for the acquisition of additional information and exploration of other avenues. The use of semi-structured interviews offers an opportunity for the subjects to expand on responses and allows for further probing by the researcher.

For the purpose of this study, data was collected from participants using the semi-structured interview approach. The interviews were conducted with SME owners and IT managers within the selected SMEs. The choice of SME owners was as a result of the fact that they were better placed to know the overall benefits of using a technology-based solution within the SMEs. On the other hand, for the determination of the system appropriateness, technology professionals were better placed to provide assessment of such constructs (Reichgelt, 2006; Ozkan, 2006).

5.6.1.3 Expert Review

Expert review is a data collection technique that seeks the views of experts in functional areas of the outcome. Expert groups are used to evaluate the research outcome (artefact) through criticisms (Molich & Jeffries, 2003). The expert group gives comments and suggestions on the presented material, which is then incorporated in to the final artefact.

Appropriate experts must be selected to ensure the appropriateness of their comments on the presented material. Experts selected for an expert review process for a study should meet four criteria, namely: knowledge and experience relevant to the research; capacity and willingness to participate; sufficient time to participate; and effective communication skills (Skulmoski, Hartman, & Krahn, 2007). For the current study, relevant experts who meet these criteria were selected. The experts were tasked with offering comments on the various stages of developing the proposed framework which the study aims to achieve and to validate the proposed framework. These stages of development are carefully described in Chapter 7 together with the expert review suggestions that were incorporated into the final research framework. The expert review validated the proposed framework to be a relevant solution in terms of SMEs using cloud computing.

Apart from the primary data collected for this study, secondary sources of data were also sought to provide a theoretical basis for the study. The use of secondary data is further described in the next section.

5.6.2 Secondary Data Collection

The secondary sources of data for the study was obtained through an extensive and thorough literature survey of Internet sources, theories, journal articles, methodologies, reports, previous studies and books. The secondary data was employed throughout this study especially during the development of the research instrument, writing of the theoretical chapters and the development of the framework. It was ensured that the content of the secondary data sources were current.

5.6.3 Pilot Study

After designing the questionnaire and interview guide, a pilot study was conducted with entrepreneurs. The objective of the pilot study is to ensure that the questionnaire was an adequate and refined research instrument to be used to gather information from respondents (Hofstee, 2006). The pilot study was critical in refining the questionnaire to allow for the most appropriate and relevant responses to be collected using the questionnaire. Some suggestions were made by respondents regarding the length, ambiguity, form, contents and phrasing of some questions. Modifications and refinements were therefore made to the questionnaire in line with these suggestions and feedback obtained from the pilot study.

5.7 Overview of the Study Area

The study area, Ghana is located on the west coast of Africa and is about 750km north of the Equator on the Gulf of Guinea and the Atlantic Ocean. With a total land area of 239,460 sq. km, Ghana is about the size of the United Kingdom. The country consists of 10 administrative regions and 170 districts. The population of Ghana is estimated to be 26,652,767 (51% female, 49% male). The most densely populated parts are the coastal areas and the Ashanti region, where about 70% of the total population live. Figure 5.7 shows a map of Ghana indicating the 10 regions of the country.

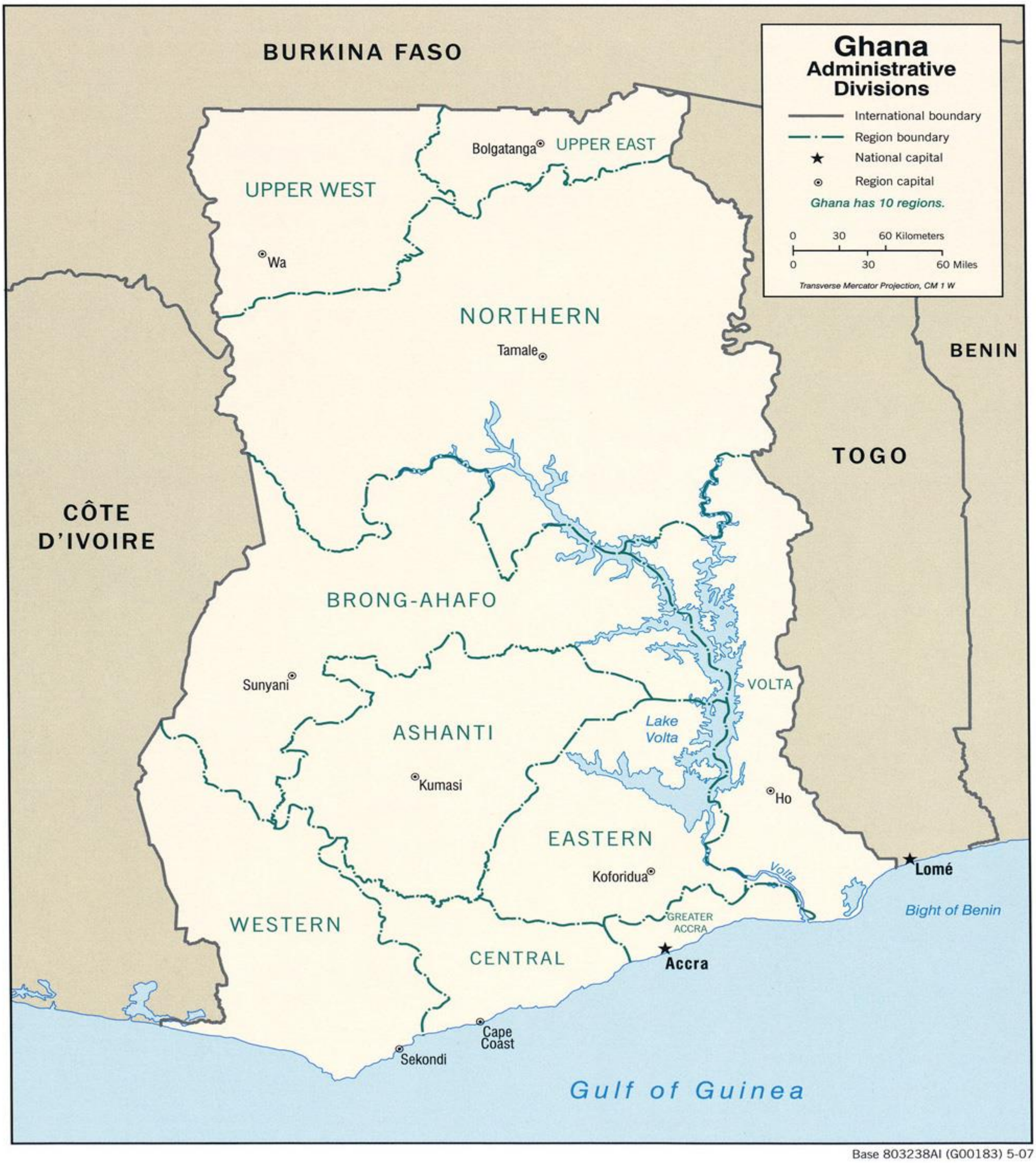


Figure 5.7: Map of Ghana (Source: Ghana Statistical Service, 2011)

The Greater Accra Region is the smallest of the 10 regions of Ghana with a total land area of 3,245 sq.km and a population of 4,010,054 (Ghana Statistical Service, 2011). This accounts for about 5.4% of the country's total population. The region is divided into sixteen districts made up of two metropolitan, seven municipal and seven ordinary districts and shares borders with the Eastern Region to the north, Volta Region to the east, Central Region to the west and the Gulf of Guinea to the south. In the 2010 population and housing census, it was reported that the region has an urban population of 16.3%. About 31.6%, 14.8%, 9.0% and 5.2% of persons in the region are involved in wholesale/retail trade, manufacturing industry, accommodation and food industry, and the agricultural sector respectively. As the region that contains the capital city of the country, it is experiencing rapid urbanization as a result of the administrative functions it performs in the area of industry, manufacturing, commerce, business, culture, education and political. It is also experiencing an influx of migrants from neighboring countries as well as other parts of the world. Figure 5.8 shows a map of Greater Accra Region and its six districts.

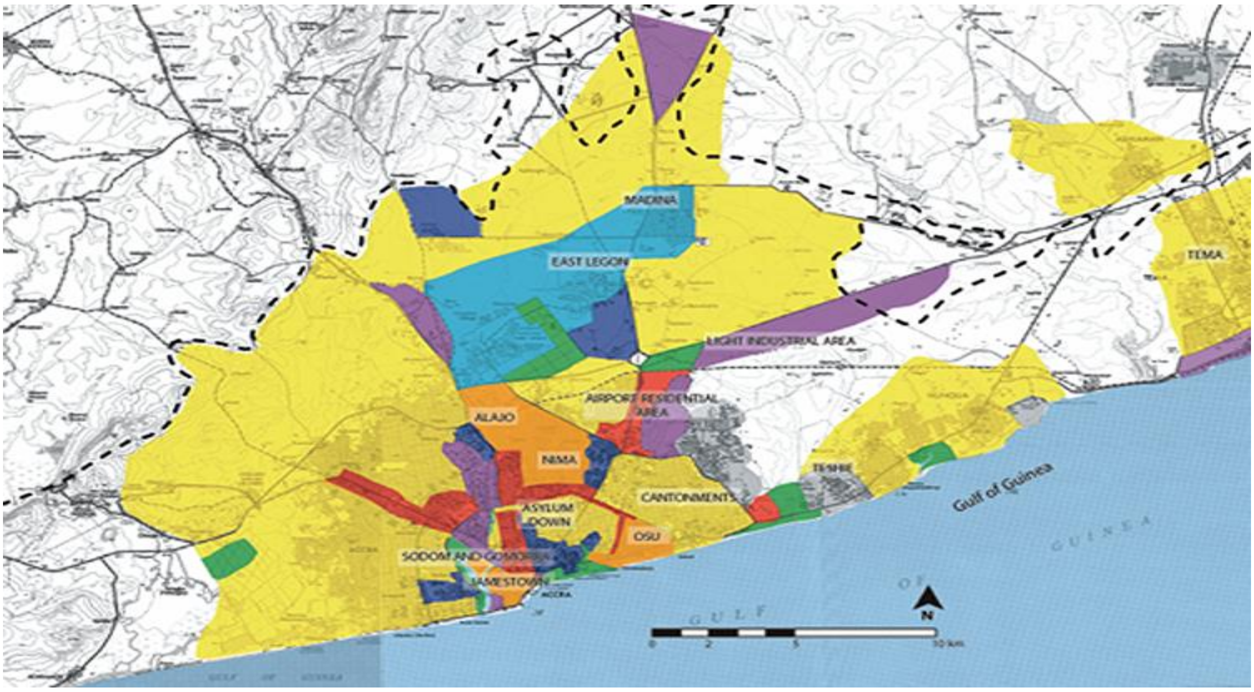


Figure 5.8: Map of Greater Accra Region of Ghana (Source: GSS, 2011)

The next section describes the steps taken to obtain the research sample.

5.8 Sample Identification and Selection Process

The selection of a suitable research sample is a big challenge in studies involving SMEs. The sample chosen for a study must reveal the characteristics of the entire population to achieve a representation of the population. According to Sarantakos (1998), the higher the representation, the higher the generalizability of the findings, which leads to a higher quality study. Selecting a portion of an entire population for the collection of information regarding that population is known as sampling (Kothari, 2004). It is therefore critical to employ a sampling strategy that is suitable for a given study.

5.8.1 Sampling Strategy

A sampling strategy is the process adopted in order to obtain a sample from a population under study (Kothari, 2004). According to Marshall and Rossman (2010), poor sampling may lead to research of low credibility and trustworthiness. The sample is selected from a part of the population and conclusions may be drawn about the population (Babbie, 2008). There is therefore the need for the sample of a research study to be representative of the population of interest (Creswell, 2007). The appropriateness of a chosen sample will ensure a valid and reliable conclusion.

For the purpose of the current study, a non-probability sampling strategy is used. This is because the study seeks to provide enough information about the context of the study. There are many types of non-probability sampling strategies. A brief description of these are provided below (Babbie, 2008; Marshall & Rossman, 2010):

1. *Quota sampling:* In this method of sampling, there is the adoption of pre-defined characteristics in the selection of units of the sample. As a result, the entirety of the sample will have the same distribution of the characteristics of the population under study.

2. *Snowball sampling:* In this method of sampling, subjects for the inclusion of the sample may refer other potential subjects within their network for the study. Referral sampling is another name for snowball sampling.

3. *Purposive sampling:* In this method, the researcher uses personal experiences to select the most appropriate sample for the research to help solve the research questions. This is often referred to as judgmental sampling.

4. *Convenience sampling:* In this method of sampling, the researcher selects the most accessible subjects for the study. This type of research produces poor quality outcome and often lacks intellectual integrity. It is however the preferred method when one is under financial and time constraints.

For this study, convenience sampling was used to select the SMEs that best fit the purpose of the study. SMEs, regardless of their location, use some form of technology. In this regard, SMEs from different sectors of the economy were conveniently selected to partake in the research. This sampling technique was used because it allows for the access of basic data and trends regarding the study. Additionally, it gives an indication of a particular phenomenon occurring within the sample and relationships among different phenomena. The next sub section explains how the sample size was calculated.

5.8.2 Research Sample

In any research study, it is ideal to select and test the whole population, but in most cases, the population is too large to include all individuals. The sampling strategy and sample size used in research can therefore be affected by the availability of resources (Saunders *et al*, 2009). This research study's limitations concern financial support and time availability for data collection and analysis. It is therefore impractical to collect data from the entire population and hence the usage of a sample strategy is essential. This study adopted the formula by Survey System (2012) as shown below to produce a sample size reflective of the entire population and with some level of precision:

$$ss = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where ss= sample size, p = population proportion, Z = confidence level usually set at 95% and C = confidence interval. With the unavailability of a pilot study or previous research study, it is not possible to estimate p and therefore for this study, p is given the default value of 0.5 to obtain a conservative sample size estimate. The confidence interval, C, is normally set at 0.05 and refers to the range for the unknown value. Using the formula, a total of 384 SMEs were selected through a convenience sampling technique to respond to the questionnaire.

Eleven SMEs participated in the interviews. This number was used as upon analyzing the data of the 11th SME there were no more new themes emerging. This point of data collection is referred to as data saturation (Creswell, 2007). The next subsection describes how the access to participants was negotiated.

5.8.3 Negotiating Access to Participants

There are many challenges and hindrances when carrying out small business surveys in developing countries (Vulliamy, Lewin & Stephens, 1990). These challenges originate from the fact that there is often inadequate list of small businesses. In order to gain access to the participants, the researcher took into consideration four problems likely to be encountered in carrying out surveys in a developing country as observed by Stephens (1990):

1. Access to individuals to interview or administer questionnaires and documents to support responses;
2. Establishing and maintaining relationships on the research field;
3. Managing the available time;

4. Operating effectively in a complex environment.

To overcome these challenges, an informed consent note was obtained to introduce the research topic, purpose of the research, the importance of collecting the data and its usage, and the assurance of confidentiality on answers provided. To gain access to the SMEs, the researcher contacted associations, agencies and government institutions lists of to obtain their members (Delmar & Davidson, 2003). Most of the literature provided by the organizations contained names of the business, their location, business activities and contacts. The organizations contacted for their list of members to assist in administering the questionnaire include:

1. Ministry of Trade and Industries (MOTI)
2. National Board for Small Scale Industries (NBSSI)
3. Association of Ghana Industries (AGI)

The first organization to be contacted was the MOTI. The ministry is the government of Ghana's lead policy advisor on trade, industrial and private sector development with the core function of formulating and implementing policies which aim at the promotion, growth and development of domestic and international trade and industry. The Ministry is also responsible for monitoring and implementing the Government's private sector programmes and activities. There is special attention by Government on the diversification of markets and the commodity export base through the promotion and development of non-traditional exports industries with the aim of developing an export-led economy. As a result, the Ministry seeks to establish policies to develop a more competitive industrial sub sector with the capabilities of making in-roads into the international market with value added products made from local resources.

The second organization to contact is the NBSSI. The NBSSI is a non-profit sector organization under the Ministry of Trade and Industry and Special Initiatives. It was established by an Act of Parliament of the Republic of Ghana and started operation in 1985. It was mandated to promote and develop Micro and Small Enterprises (MSEs) since the Government views this sector as having the potential to contribute to the reduction of high unemployment and to the growth of the economy. The Government in an attempt to create a single, dynamic and integrated organization to adequately respond to the needs of the small-scale enterprises sector, merged the Ghana Enterprises Development Commission (GEDC) in 1991 and the Cottage Industries Division of the Department of Rural Housing and Cottage Industries in 1994 with the board. Aside from its head office, NBSSI has secretariats in all 10 regional capitals and Business Advisory Centres (BACs) in one hundred and ten (110) district capitals.

The final organization contacted was the AGI. The AGI is a non-profit organization established by a group of indigenous manufacturers in 1985. The association was first known as the Federation of Ghana Industries, later becoming the Ghana Manufacturers Association. In 1994, it adopted a new constitution that saw the expansion of its activities and membership and this led to the current name Association of Ghana Industries. It currently has a membership of over 1,500 from both private and public sectors. The AGI seeks to contribute to the growth and development of industries by creating an enabling business environment for industries to become competitive.

5.9 Data Analysis Techniques

Data analysis is a critical stage in any research process. According to Mouton (2005), it involves reducing the collected data into manageable themes, patterns and establishing relationships between them. It begins with the design of the study, and then the data collection process after which the analysis becomes the focus and ends with the writing of a report.

For this study, the survey gathered both quantitative and qualitative data. Hence, the data analysis took into consideration both research methods in deciding the type of data analysis to use (Curran & Blackburn, 2001). Additionally, data was gathered from experts in the field of SME development and technology, and from literature. The following subsections explain how the primary and secondary data collected were analysed.

5.9.1 Primary Data Analysis

The analysis of the quantitative data involved two major steps: data preparation and descriptive statistics. The process of data preparation begins with editing, followed by coding and finally entering the data into the computer which then transformed it into a database structure. Descriptive statistics was then employed to explain the basic features of the data collected to help show a summarized form of the data. The central tendency such as mean, range, standard deviation and frequencies was used to explain how respondents have answered the questions and how widespread their responses were.

The qualitative data was analysed using thematic analysis. This approach enabled the researcher to report the experiences of the participants gathered during the interview process. Thematic analysis is regarded as a useful analytic approach to analyse qualitative data and present rich, detailed, and complex accounts of data (Braun & Clarke, 2006). The approach involves *“identifying, analyzing and reporting patterns (themes) within data”* (Braun & Clarke, 2006:79). It has proved to be flexible and an effective analysis strategy for interview data due to the fact that any pre-existing theoretical framework can be used (Braun & Clarke, 2006). Hence, the researcher is of the conclusion that its application in the current study would be suitable and beneficial.

Changes to the framework were made in response to qualitative data obtained from expert reviews. The outcome of the expert review helped to refine the proposed framework.

5.9.2 Secondary Data Analysis

Analysis tries to establish a better understanding of the data through an assessment of the relationships between concepts, constructs, or variables, and to identify the existence of trends and themes in the data. As a result, the secondary data gathered in this study was analysed using content analysis of cloud related concepts that influence its adoption. Patterns were thus drawn from the content analysis which was incorporated in the development of the proposed framework.

5.10 Trustworthiness of the Study

Trustworthiness of a research study concerns the extent to which the data and its analysis are believable and trustworthy. According to Holloway and Wheeler (2002) a study is authentic when the strategies used are appropriate for the true reporting of the participants’ ideas, when the study is fair; and when it helps participants and similar groups to understand their world and to improve it. Authenticity was achieved through the researcher’s fairness to all subjects and getting their consent throughout the study. Creswell (1998) point out that trustworthiness in a research study can be achieved by using four criteria: credibility, transferability, dependability and conformability. These are explained below:

1. *Credibility:* Credibility is the level to which the data and data analysis are believable and trustworthy. Holloway and Wheeler (2002) point out that participants must be able to understand the meaning they assign to situations and the truth of outcomes in their own social context. The use of expert reviews and multiple data collection methods ensured the credibility of this study.

2. *Transferability:* This is the extent to which the research findings can be applied to other settings. This can be achieved by presenting a detailed description of the settings under study to give enough information for a good judgment of the applicability of the findings to other settings (Seale, 1999). This study achieved

transferability as the proposed framework can be applied to other users with similar settings who are considering adopting and using a new technology.

3. *Dependability:* According to Oates (2008) dependability concerns how well the research process is recorded and the data documented. There is the need for consistency and accuracy for a study to be considered dependable. In the case of the current study, dependability was achieved through the use of published literature and feedback from experts in the area of the study. The use of theories and models add dependability since they have been tested in several research studies. The theories and models used in this study are the Technology Acceptance Model proposed by Davis (1989) and the CIA Triad by Steichen (2010).

4. *Conformability:* This is the ability to corroborate research findings with others. That is, there is the need for the researcher to substantiate how constructs, themes and interpretations were arrived at. This study used questionnaires and interviews to confirm the findings. In addition, the inclusion of feedback from experts led to the development of the proposed framework.

These four criteria were applied to ensure the trustworthiness of this study. These criteria are assessed in chapter 8. The issue of ethics is of great concern in any research that involves humans (Saunder et al., 2009). The next section therefore explains how ethical concerns relating to this study were handled.

5.11 Ethical Considerations

Issues of ethics likely to affect participants were considered in the planning of the research design and methodology for this study. The research methodology adopted was therefore in agreement with suitable ethical norms. Sticking to ethical norms in research is important in any research (Kothari, 2004).

An ethical clearance certificate for the research was obtained from the UFH Ethics Committee (see Appendix A). The issue of confidentiality was maintained by making sure data collected for the research was made available to only the research team. Personal details of participants were kept anonymous by substituting them with identifiers during analysis. The questionnaires were conducted with willing participants and in all cases formal consent was sought. Before the interviews were conducted, participants signed the informed consent form. The form ensured agreement to be involved in the study and acknowledged that their rights are protected.

5.12 Conclusion

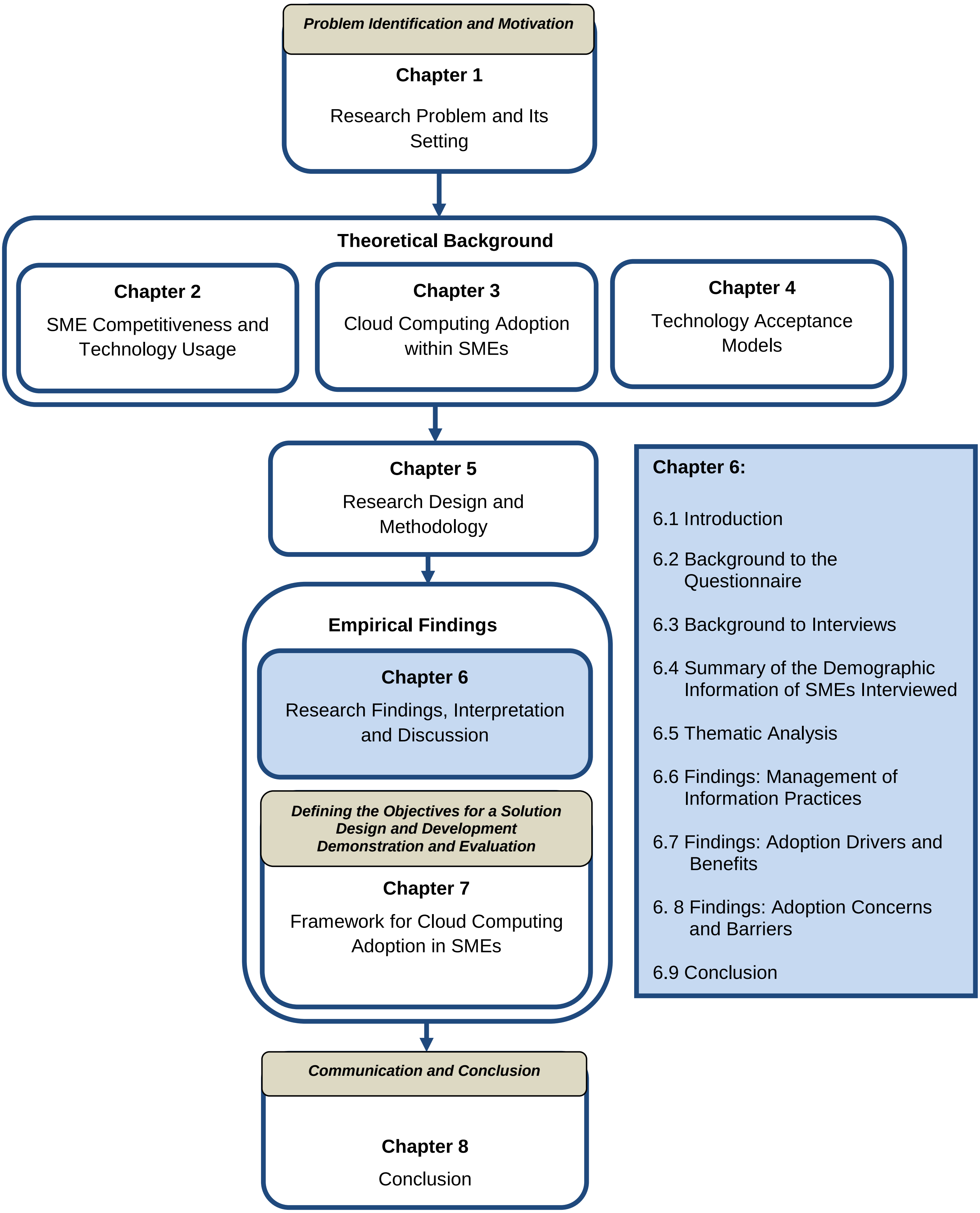
This chapter presented the methodological approach adopted in the study and the justification for adopting a particular methodology. It first discussed available research paradigms underlying all research, namely positivism, interpretivism, critical postmodernism and pragmatism. This was followed by arguments to support the use of a particular paradigm relevant for this study. This study used two paradigms namely, pragmatism and interpretivism. Pragmatism was used because it focuses on the development of practical applications, consequences, relevance and usefulness. Interpretivist beliefs was also adopted to help interpret the findings and results of the interview to gain an understanding of how cloud computing can influence business operations.

The research design chosen for this study is the design science methodology and was also presented. Design science methodology seeks to create and evaluate an IT artefact to help solve an identified organizational problem. In this study, the artefact is the proposed framework and the identified problem is the uncompetitive nature of SMEs.

The chapter further discussed the instruments that were used to collect the empirical data, and how the collected data was analyzed. In this study, the instruments used to collect the primary data were a web-based questionnaire, interviews and expert opinion. The secondary data was sought through the review of relevant literature. The questionnaire was analyzed using descriptive statistics and the interview data through thematic analysis. Recommendations from experts were used to evaluate and refine the developed artefact. Moreover, the sample selected for the collection of the data was also outlined in this chapter

Finally, measures taken to ensure the trustworthiness of this study were evaluated. All discussions on credibility, conformability, dependability and transferability will allow for a successful study, resulting in the development of the proposed cloud computing adoption framework. The next chapter (chapter 6) describes the findings from the questionnaire and interviews.

This study seeks to propose a framework for cloud computing adoption by SME. Appropriate research design and methodology was therefore employed for this study to assess the adoption of cloud computing within SMEs to achieve a successful adoption process. The results of the findings are presented in the next chapter.



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Chapter 6: Research Findings, Interpretations and Discussion

6.1 Introduction

This research seeks to investigate how small and medium-sized enterprises (SMEs) in the Accra-Tema Metropolis of Ghana can become more competitive by adopting cloud computing in their operations. The literature chapters therefore discussed some of the adoption issues, concerns, benefits, and motivators that affect the decision to adopt and use cloud computing services. The research design and methodology employed has also been outlined in the previous chapter. This chapter presents a discussion of the results obtained from the web-based questionnaire and face-to-face interviews as described in Chapter 5.

The results obtained are grouped into two. The first phase analyzed the web-based questionnaire and described the results using descriptive statistics. The questionnaire data is important as it is used to confirm some of the issues, concerns, benefits and motivating factors associated with the widespread adoption and use of cloud computing. These factors are an important component of the cloud computing adoption framework developed to solve the underlying research problem. The framework is presented in the next chapter. In the second phase, the responses obtained from semi-structured face-to-face interviews of SMEs in the study area are presented. The findings of the interviews aim to explore in detail those factors that impact on the adoption of cloud computing by these businesses.

Phase one of this chapter gives a description of the research instrument and the response rate. This is followed by information about the pilot study and the background information of the respondents of the questionnaire and interview are also described. The exact, relevant findings from the questionnaires and interviews in relation to the research questions are then discussed in phase two. The themes and issues identified in the data are then described. A summary of the results is then presented to end the chapter. The findings from both the questionnaires and interviews are important as they are used to develop the framework presented in Chapter seven.

6.2 Background to the Questionnaire

The study employed web-based questionnaires, interviews and expert opinion as primary sources of data, and literature review of published studies as secondary sources of data. Figure 6.1 shows the data collection process used for this study.

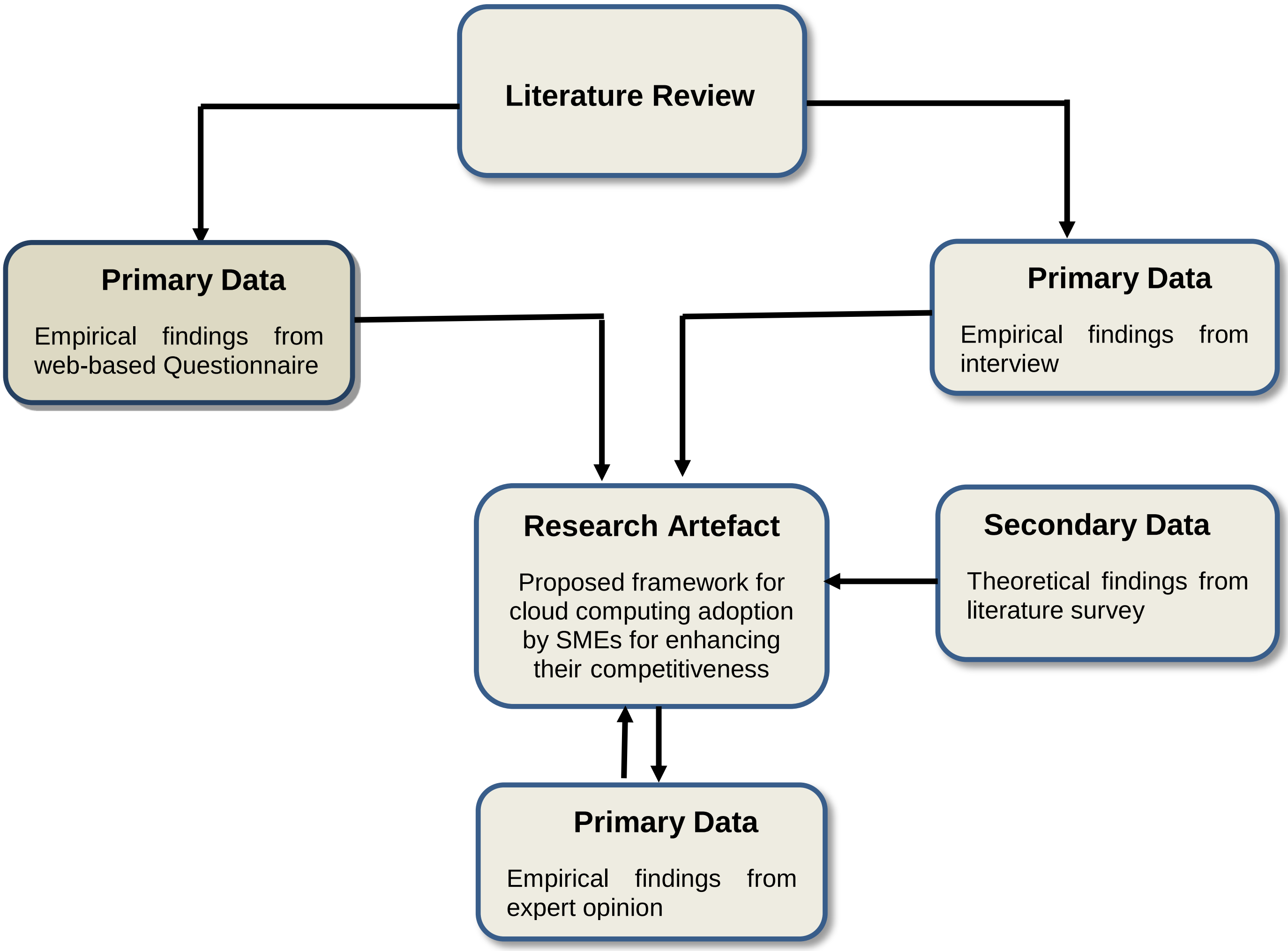


Figure 6.1: Data collection process (Source: Own Creation)

From figure 6.1, the reviewed literature was used as the theoretical basis for the study. The initial research framework, interview and the web-based questionnaire were influenced by this theoretical base. The interview and web-based questionnaire were used to collect the empirical data. The recommendations from experts in their assessment of the initial framework, together with the empirical findings from the primary data together led to the development of a proposed framework for the adoption of cloud computing by SMEs. The proposed framework which is the research artefact was formulated after careful analysis and incorporation of recommendations from experts and empirical findings which were combined with the secondary data.

6.2.1 The Research Instrument

In phase one, a web-based questionnaire (see Appendix B) derived from a thorough literature review was distributed electronically to selected SMEs in the Accra-Tema Metropolis of Ghana. The validity and adequacy of the research instrument was tested using a pilot study and appropriate changes were made to the original questionnaire. The questionnaire was made up of both open and closed-ended questions and centered on users experience and knowledge of cloud based applications. Some questions also focused on the perceived adoption motivators and concerns, and the management of information regarding the use of cloud computing applications.

6.2.2 Pilot Study

In a research project, a pilot study is conducted to ensure a refined and adequate questionnaire that will be a good research instrument for collecting relevant information from respondents (Hofstee, 2006). The questionnaire was administered to three SMEs for them to identify and make changes to unclear items in the questionnaire. They were to give their views and make recommendations for the questionnaire.

The feedback from the pilot study indicated that the questionnaire was simple and easy to answer. Suggestions were made for the reconstruction of certain statements for a better understanding. As a result, some statements were adjusted to accommodate these suggestions.

6.2.3 Response Rate

In the study, a total of 384 SMEs in the Accra-Tema Metropolis of Ghana were invited to complete the questionnaire. The targeted respondents were business owners and managers. An SME’s decision to adopt and use cloud computing is often made by business owners and managers and hence these are considered an appropriate group to target.

261 questionnaires were completed and none contained substantial uncompleted sections. Based on the completed questionnaires, a response rate was computed from the formula below:

$$Response\ Rate = \frac{Number\ of\ Completed\ Surveys}{Number\ of\ Participants\ Contacted} \times 100$$

$$Response\ Rate = \frac{261}{384} \times 100$$

From the computation above, the response rate for this research was 68%. According to (Oates, 2008), during a research study it is common to have a response rate of 10%, but a response rate of 30% or more is usually preferred. Hence the response rate of 68% was considered acceptable for this study.

6.2.4 Demographic Characteristics of Respondents

The instrument used in the study captured the demographics of respondents and that of the SMEs. The information gathered is now presented below starting with the respondents and then the firm.

6.2.4.1 The Demographic Data of Respondents

The background characteristics of respondents were examined using the following variables: gender of respondent and their educational level.

Gender

The number of respondents who were female was 82 representing 31.42% of the surveyed population, while 179 were male representing 68.58% of the population surveyed.

Table 6.1: Gender of SME owner/manager

Gender	Number of Respondents	Percentage (%)
Male	179	68.58
Female	82	31.42
Totals	261	100.00

Most of the respondents were surveyed were males. It must however be noted that the gender representation is only a reflection of those who were surveyed and not of the entire SME ownership and mangers in the study area.

Educational Level

The response about the educational achievements of respondents is indicated in Table 6.2. Every respondent has at least completed high school or obtained a certificate with 8 representing 3.07% and 11 representing 4.21% having a professional qualification and diploma respectively. Most respondents, 174 representing 66.67% of the surveyed population have completed a bachelor's degree and 68 representing 26.05% have a postgraduate degree.

Table 6.2: Educational level of respondents

Highest Level of Education	Number of Respondents	Percentage (%)
High School	0	0
Certificate	0	0
Diploma	11	4.21
Professional	8	3.07
Bachelor's Degree	174	66.67
Post Graduate	68	26.05
Totals	261	100.00

For the high educational achievements, the value is realised through the varied responses which will be gathered with regards to the decision to adopt and use cloud computing that can be attained through this varied knowledge base. The varied understanding of needs, adoption and use of cloud computing applications by respondents meant that richer responses were gathered from respondents.

6.2.4.2 Background Data of SMEs

A total of 261 SMEs participated in the study. The following variables were used to capture their demographics: Number of employees, years of operation, industry sector, market scope of SME, and their current state with regards to cloud computing.

Number of Employees

The study adopted the definition of the SMEs by National Board for Small Scale Industry (NBSSI) which specifies that the number of employees in SMEs should not exceed 99 people (Mensah, 2004). As a result, the SMEs surveyed had employees falling below 99 as represented in the table below.

Table 6.3: Number of Employees in SMEs

Number of Employees in SME	Number of Respondents	Percentage (%)
1-5	119	45.59
6-29	71	27.20
30-99	71	27.20
Totals	261	100.00

In the survey 119 participating SMEs had between 1- 5 employees representing 45.59% of the total participants. There was however an even representation of SMEs with 6 to 29 employees and those with 30-99 employees. Both had 71 SMEs participating in the study and represented 27.20% each. It is clear therefore that the majority of the SMEs surveyed had their number of employees falling between 1- 5 and therefore were small enterprises. The size of SMEs can have an effect on their innovativeness as larger SMEs have an enabling condition of access to key resources and to address these key issues.

Years of Operation

Most of the SMEs that participated in the survey had been operating for about five years, as represented in the table below.

Table 6.4: Years of Operation

Years of Operation	Number of Respondents	Percentage (%)
Less than a Year	42	16.09
Between 1-5 Years	114	43.68
More than 5 Years	105	40.23
Totals	261	100.00

Only 42 SMEs surveyed had been in operation for less than one year representing 16.09% of the participating SMEs. 114 SMEs had been running for between 1 and 5 years, representing 43.68% and 105 of them had been in operation for a period of over 5 years. Length of operation matters in terms of innovation as firms in their early years spend time to contract out and begin a programme of product innovation later. Additionally, the period distribution may also reflect the sustainability or otherwise of SMEs operations.

Industry Sector

The industry sector that SMEs surveyed can be categorised into seven types namely: Technology, Service, Manufacturing, Education, Healthcare, Financial services and Aviation. The proportions of their representations are indicated in the table below.

Table 16.5: Sector of SME Operation

Sector of SME	Number of Respondents	Percentage (%)
Aviation	13	4.98
Financial services	17	6.51
Healthcare	15	5.75
Education	31	11.88
Manufacturing	19	7.28
Service	98	37.55
Technology	68	26.05
Totals	261	100.00

The majority of SMEs 98 (37.55%) and 68 (26.95%) surveyed operate in the service and technology industries respectively. While 31 SMEs operated in the educational sector representing 11.88%, almost half of this number 17 representing (6.51%) were found in the financial services sector. The manufacturing, healthcare and aviation sector SMEs were represented by 19 (7.28%), 15 (5.75%) and 13 (4.98%) respondents respectively. It is clear therefore that, most of the SMEs operating in the sample area are operating in the service sector. The diverse nature of the sample indicates that SMEs cut across the various sectors of the Ghanaian economy and the ability to absorb technology varies significantly depending on their sector.

Market Scope

Market scope is the horizontal extent of SME’s operations. SMEs surveyed targeted their operation towards four market blocks namely local, national, regional and international. Local market includes customers located within the region the product or service is produced. National market considers domestic marketplace for goods and services operating within the borders of and governed by the regulations of a particular country. In regional market, customers buy products and services within a given geographical location. In international market, the buying and selling of product and services occurs in more than one country. Their representations are shown in table 6.6 below.

Table 6.6: SME Market Scope

Market Scope	Number of Respondents	Percentage (%)
Local	28	10.73
National	130	49.81
Regional	65	24.90
International	38	14.56
Totals	261	100.00

Most of the surveyed SMEs targeted their operation at the people within the country. Of the surveyed SMEs, 130 aimed at the national market representing 49.81%, while just a few 28 (10.73%) of the SMEs targeted the local market. Other SMEs try to reach regional (65 which is 24.90%) and international (38 which is 14.56%) markets with their produce. This indicates that a majority of the SMEs try to satisfy the demand within the country before looking outside. However, to survive and become relevant in the present competitive era, SMEs have to enter the regional markets to be competitive despite the challenges of globalization, liberalization and technical progress.

SMEs are at various levels of cloud computing adoption decisions. The proportions of the levels are shown in Table 6.7 below.

Table 6.7: Adoption Decision Stage

Cloud Adoption Stage	Number of Respondents	Percentage (%)
Adopted Cloud Computing	39	14.94
Intend to Adopt Cloud Computing in Six Months	89	34.10
No Immediate Intention to Adopt Cloud Computing	132	50.57
Totals	261	100.00

Most of the SME surveyed 132 (50.57%) don't not have any immediate intention of adopting any cloud computing service compared to only 39 (14.94%) of respondents who are currently using some cloud computing service. However, 89 (34.10%) hope to adopt cloud computing services within the next six months. Though this is encouraging, it is clear the level of adoption is very low.

The presented demographic characteristics of the sample population were key in providing a general background of the surveyed SMEs. With this background information, the next section discusses the background and demographic information of the participants for the interviews.

6.3 Background to Interviews

The outcome of the quantitative phase served as the basis for in depth semi-structured face-to-face interviews with purposely chosen participants. The reviewed literature served as the theoretical basis for the study. The development of the interview questions was influenced by this theoretical base. The interview questions were also used to collect the empirical data. The subsection that follows shows the demographic information of participating SMEs.

Table 6.8: Firm's background and demographic information (Source: Own Creation)

SME Reference	Industry	Adoption Stage	Interviewee Position	Educational Level of Interviewee	Category of SME	Years in Operation	Number of Departments	Number of people in Interviewee's department	Main Product /Service	Primary client
G1	Technology	Adopter	Business Development Manager	Bachelor's	Small	Between 1-5	3	Less than 5	Websites/ Web applications	Businesses
G2	Technology	Adopter	Technical Manager	Bachelor's	Medium	More than 5	4	Between 6-29	Mobile applications	Businesses
G3	Technology	Adopter	IT Manager	Bachelor's	Medium	More than 5	5	Less than 5	Web applications	Farmers/ NGOs
G4	Service	Adopter	IT Manager	Bachelor's	Medium	More than 5	5	Less than 5	Conformity assessment	Exporters/ Importers
G5	Technology	Prospector	Technical Manager	Postgraduate	Medium	More than 5	4	Between 6-29	Selling/ Installation of computer devices	Schools/ Businesses
G6	Services	Prospector	IT Manager	Postgraduate	Medium	More than 5		Less than 5	Insurance brokerage	General public
G7	Service	Prospector	IT Manager	Bachelor's	Small	Between 1-5	5	Less than 5	Conformity assessment	Government
G8	Service	Prospector	IT Manager	Bachelor's	Medium	More than 5	8	Less than 5	Inspection/ Verification/ certification	Exporters/ Importers
G9	Aviation	Prospector	IT Manager	Postgraduate	Medium	More than 5	8	Less than 5	Air transport services	Airline companies
G10	Manufacturing	Non-adopter	IT Manager	Bachelor's	Medium	More than 5	6	Less than 5	Pharmaceuticals	Hospitals/ Pharmaceutical shops
G11	Manufacturing	Non-adopter	General Manager	Bachelor's	Medium	More than 5	3	Less than 5	Palm drink/soup	General public

Table 6.8: Firm's background and demographic information (Source: Own Creation)

6.3.1 Overview of Interviewed SMEs

The sample for the interview consisted of 11 SME participants. This sample size was used for this phase of the study because at the time of analyzing the data from the 11th SME there were no more new themes emerging, in other words the saturation point had been reached. Prior to the interviews, the researcher double checked if the interviewee agreed with the fact that the interview would be recorded. As such, permissions were sought to have the interview recorded on two occasions: the informed consent form (see Appendix D) and the verbal affirmation prior to the start of the interview. The interviews were transcribed for the analysis.

6.3.2 Participating SMEs

The SMEs were selected from different sectors – technology, services, manufacturing and aviation considering the sectorial diversity as a requirement for reflecting their technology needs and practices. In order to avoid a pro-adoption bias (Roger, 2003), there was a random sample of both adopters, prospectors and non-adopters of cloud computing for the interviews. Using Roger's (2003) classification and based on responses, the eleven SMEs interviewed were grouped into three according to the extent to which an SME is likely to adopt cloud computing than others. The interview respondents are described in Table 6.8 in terms of a reference number, SME's industry, SME's adoption stage, position in the company, educational level, category of SME, SME's years in operation, SME's number of departments, number of people in the interviewee's department, SME's main product or service and the SME's primary client.

Interview respondents were selected from similar organisational positions considering their technical and managerial expertise to evaluate the firm's existing information technology (IT) system as well as cloud computing services. The SMEs were assigned codes between G1 to G11 to help uniquely identify the respondents. The subsection below provides a summary of the demographic information of participating SMEs.

6.4 Summary of the Demographic Information of SMEs Interviewed

The SMEs interviewed were randomly sampled from different sectors of the economy and were categorised into three: adopter, prospector and non-adopter SMEs based on their cloud computing adoption stage. Below are summaries of the demographic information of each category of SME interview.

SME's Adoption Stage

The SMEs interviewed were at different stages of adoption. The representations are shown below in Table 6.9

Table 6.9: Adoption Stage of SME

Adoption Stage	Number of Respondents	Percentage (%)
Adopter	4	36.36
Prospector	5	45.45
Non-adopter	2	18.18
Totals	11	100.00

Whereas 4 (36.36%) of SMEs interviewed have adopted cloud computing service in their operation, 2 (18.18%) have no immediate intention of adopting any cloud computing service. However, 5 (45.45%) of the SMEs have not adopted any cloud computing service and have the intention of doing so within the next three years. Though this is encouraging, its shows that the usage of cloud computing services are low among SMEs.

Category of SME

The SMEs were categorised based on the number of employees. The results are shown in Table 6.10 below.

Table 6.10: Category of SMEs

Category of SME	Number of Respondents	Percentage (%)
Small	2	18.18
Medium	9	81.82
Totals	11	100.00

A majority of the interviewed SMEs (9 which is 81.82%) were medium-sized enterprise. Only (2 which is 18.18%) were small enterprise. The larger the size of an enterprise the better the condition of access to key resources.

Years of Operation

The SMEs have been operating for different numbers of years. Their years of operation are reported in Table 6.11 below.

Table 6.11: Years in Operation

Years in Operation	Number of Respondents	Percentage (%)
Between 1-5	2	18.18
More than 5	9	81.82
Totals	11	100.00

Most of the SMEs (9 which is 81.82%) interviewed have been in operation for more than 5 years. This is good as the period distribution reflects the sustainability of SMEs operation. Only (2 which is 18.18%) have been operating for about 5 years.

Educational Background of Respondents

The levels of education of interviewees were sought and the results are provided in Table 6.12 below.

Table 6.12: Educational Level

Highest Level of Education	Number of Respondents	Percentage (%)
Bachelor's Degree	8	72.73
Post Graduate	3	27.27
Totals	11	100.00

A majority of interviewees (8 which is 72.72%) have obtained their bachelor's degree. Only (3 which is 27.27%) interviewees had postgraduate degrees. For the high educational achievements, the value is realised through the varied responses which will be gathered with regards to the decision to adopt and use cloud computing that can be attained through this varied knowledge base.

6.5 Thematic Analysis

The interviews were transcribed and data analysed using thematic analysis as suggested by Braun and Clarke (2006). The use of thematic analysis allows for the identification, analysis, and reporting of themes in qualitative data. Braun and Clarke (2006) outlined six-phased approach to thematic analysis.

Phase one requires getting conversant with the data collected. In this study this was achieved through careful transcribing of the actual words of the interviews and generating meaning from the data. In phase two, initial codes regarding relevant aspects of the primary data are created for all data collected. This is illustrated with examples in Table 6.13.

Table 6.13: Data Extracts Coded Multiple Times

Data Extract	Respondent	Code
It has happened several times, where the provider could have their own technical issues, overwhelmed or their systems are failing. Also internally our systems can have issues because you know there is power problem. Once there is no power, you cannot go online to get the information. So even though the information may be on the service provider's platform, you cannot go online to access it. In Ghana also there is the problem of ISPs not providing stable services, so it difficult to big data from the provider's platform.	G2	Concerned about Internet connectivity to the cloud Concerned about power outages.
We have a lot of knowledge deficiency. I don't think most of the personnel know about cloud computing. We lack the knowledge and will therefore need training. Another issue putting all your information somewhere. If you have your own system in-house and there are issues, you can easily walk to the server room. It then becomes a question of whether you know or you don't know how to solve it. But when it is in the cloud, when you can call and nobody picks and you don't know what is happening, it will be frustrating.	G10	Need for training on cloud computing Prefers data to be hosted in-house to ensure constant availability

Once you invest in minimal hardware, you are not concern with hard disk crushes, server crushing, cables breaking etc. Even if the initial cost is high, the long term cost benefits are enormous. You can the concentrate on using the solution rather than managing the infrastructure	G5	Score economic benefits on hardware and software Reduced manpower

In Table 6.13, there is the indication that in phase two, data extracts may be coded multiple times. Multiple data extracts associated with sets of data extracts were grouped with examples illustrated in Table 6.14.

Table 6.14: Data Extracts Grouped Under the Same Code

Data Extract	Respondent	Code
Cloud is an Internet based service, so you will require having Internet access at all cost if you want to access the cloud.	G7	Concerned about connectivity to cloud
Without a stable Internet connection, you cannot use cloud.	G11	
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	Knowledge and technical skills deficiency in cloud
I don't think most of the personnel know about cloud computing. We lack the knowledge and will therefore need training	G10	
Everybody working here has some basic knowledge when it comes to computing	G11	
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	G1	Concerned about data control
My data and everything in somebody's care and as a business, how that information is being used you don't know. It is in the control of somebody.	G11	

Table 6.14 shows that some of the codes could also be associated with more than one data extract. In this phase (phase two), the data extract was not interpreted but rather a coding framework based on what respondents actually said was created.

All identified candidate (preliminary or unrefined) themes together with initial identified themes forms the outcome of phase three. Thus in phase three candidate themes and sub-themes from the coded data extracts were identified. An extract of one such candidate theme and sub-theme is given in Table 6.15.

Table 6.15: Data Extracts Classified Under the Same Code

Candidate theme	Sub-themes	Code
Knowledge of adoption approach	Private cloud deployment Public cloud deployment Hybrid cloud deployment	.......I should say we run a tiny version of such here in a rack to manage our local development. So I can say we run a sort of private network in-house (G3).
		Cloud computing allow users to share resources on the provider's platform (G9).
		I think hybrid. This is because the complexity of

		what we are putting out either require us to go private, public or both (G2).

The interpretive nature of qualitative study means that only latent themes were identified. Braun and Clarke (2006) suggest the need to include all candidate themes in phase four. As a result, phase four involved the refinement of the candidate themes. In phase four, the collated data extracts was carefully inspected to ensure whether or not they tied into the candidate themes with which they are associated. After this, themes across the entire data set were evaluated. This was done to ensure that the themes identified were valid in relation to the collected data. Thus, this phase was characterized by the identification of new themes, and the merging and elimination of entire themes. An extract of one such theme and the data extracts under it is illustrated in Table 6.16

Table 26.16: Refined Theme with Collated Data Extracts

Refined theme	Data extracts
Adoption approach by assumption	I think private cloud will do. Because of the sensitivity of our job, throwing this on say a public platform, the risk involved will be quite higher compared to private (G7).
	Private cloud. Because we are not so sure how safe our information will be in a public and hybrid. Our data is expensive, so we wouldn't mind spending to get a private cloud just to protect our data (G10).
	We have looked at private and hybrid cloud but our business size does not recommend those options. So public cloud for now is where we are (G3).
	Sometimes we have portions of our work that may require us to be in the private and portions that reside in the public (G2).

The output of phase four was used to construct a thematic map (Figure 6.2). This serves as the output of phase five. Phase Six concluded the process of analysis with a detailed interpretation of the identified themes and the collated data extracts associated with them. According to Fereday and Muir-Cohrane (2008), this illustrates interpretive rigor.

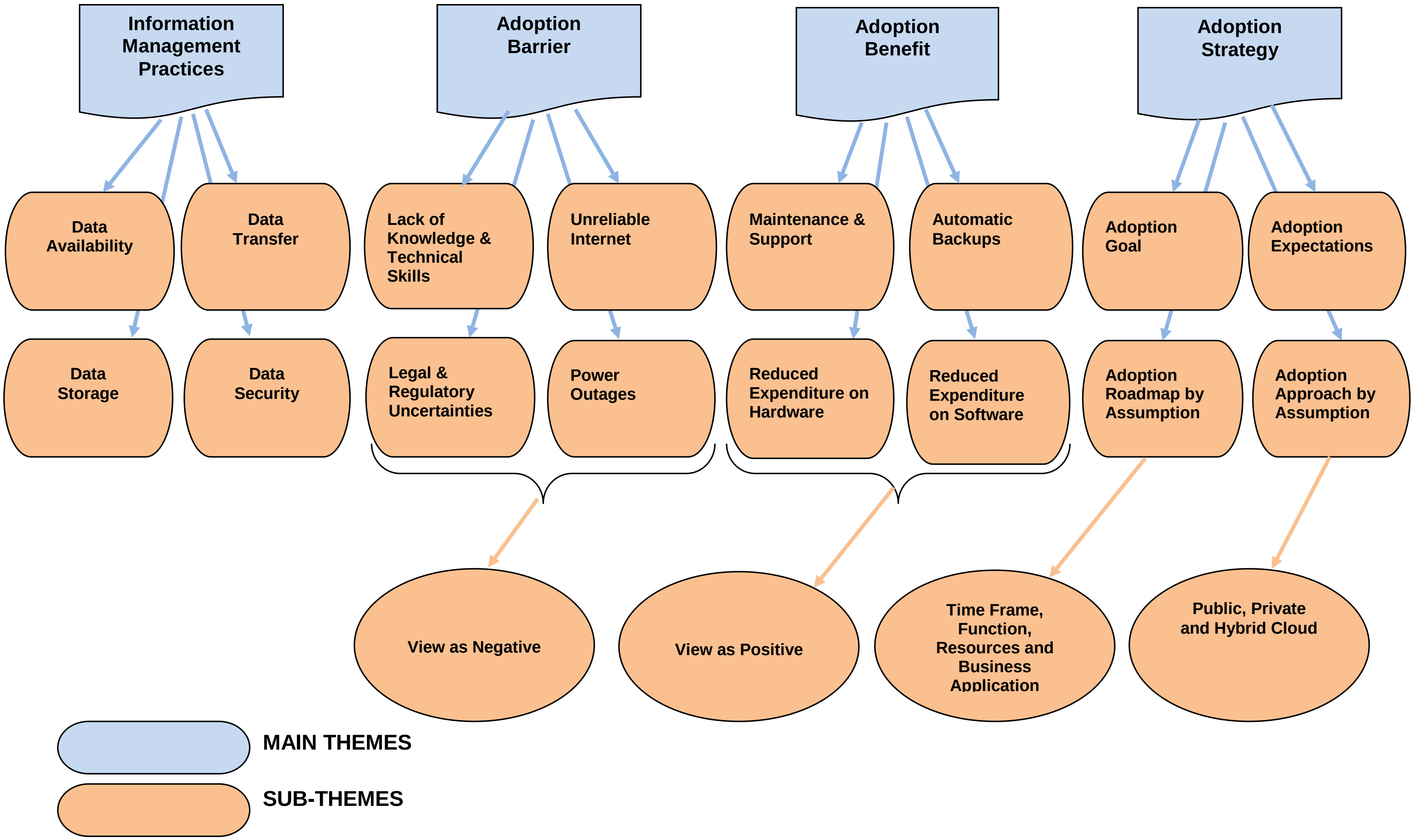


Figure 36.2: Final thematic map (Source: Own Creation)

6.6 Findings: Management of Information Practices

An objective of this study is to investigate how the adoption of cloud computing can improve information practices for SMEs in the Accra-Tema metropolis of Ghana. SMEs were therefore asked how issues of information management influence their decision to adopt cloud services and this was achieved using questionnaires and interviews. An in-depth discussion of the findings relating to this objective follows.

6.6.1 Questionnaire Findings

The responses were measured on a Likert Scale which ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). The results are presented in Table 6.17

Table 6.17: Information Management

	Information Management	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq. / %
1	Data storage	0	0.00	5	1.92	46	17.62	169	64.75	41	15.71	261 / 100
2	Difficulty in data transfer	2	0.77	44	16.86	104	39.85	106	40.61	5	1.92	261 / 100
3	Data security implications	0	0.00	9	3.45	33	12.64	131	50.19	88	33.72	261 / 100
4	Availability	0	0.00	0	0.00	104	39.85	140	53.64	17	6.51	261 / 100
5	Accessibility	5	1.92	0	0.00	58	22.22	168	64.37	30	11.49	261 / 100

The majority of the respondents (210 which is 80.46%) indicated that cloud computing allows them to store large amount of data. Although almost half (111 which is 42.53%) respondents believe that the transfer of data over a cloud infrastructure is achieved with difficulty, (157 which is 60.15%) indicated that cloud computing is highly available. The majority of the respondents (219 which is 83.91%) were worried about the security of their data stored through cloud services. To have some level of control over their data, 198 (75.86%) of the respondents want their data to be highly accessible.

6.6.2 Interview Findings

A total of 11 participants were interviewed using a semi-structured interview guide (see Appendix B). The following are relevant findings from the interviews, relating to the management of information.

An adopter stated that *"cloud computing allows you to store a lot of data and with the processing capacity on these, it allows you to do complex calculation that gives you* *information"* (G2). An optimistic non-adopter G11 added: *".......when we join cloud computing, it will help us access information fast".*

Respondents feel cloud services are highly accessible as is evident in a comment made by prospector G5: *"It is very accessible and therefore very advantageous. With cloud computing once you have Internet, you can easily access your information from anywhere".* Respondents expect service providers to *"....store their critical data and they have to make sure it is available on demand and they have to put measures in place to protect the data"* (G4). This was further corroborated by G3: *"I know I wouldn't be going round chasing cloud problems. So I expect a cloud computing provider to give me absolutely high up time and good support".*

Despite the high expectations from cloud service providers, respondents are skeptical about the manner in which their information is handled by service providers. Participant G4 stated: *"Part of our code of ethics stresses on how to handle our data because the data might have proprietary attachment to it. So we are very careful on how our data is handled by others".* As a result, *"we need to profile the service provider to ensure that the service provides is up to the task of providing you the needed capacity in a secured and competitive manner"* (G2). Respondents want to have control of their data at all times because of its sensitivity. For some, "*Once you have given your data to a third party, you want to be sure it is under your control"* (G9). This view was consistent with others:

1. "*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"* (G1).
2. "*We want to have control of our data and we also want to have control of our servers, so that is one of the things we look at from our provider*" (G3)
3. "*My data and everything in somebody's care and as a business, how that information is being used you don't know. It is in the control of somebody*" (G11).

From these interview extracts it is affirmed further that the management of information over a cloud platform is a key determinant of successful cloud computing adoption within SMEs.

6.6.3 Summary of Findings on Information Management Practices

A conclusion can be drawn from the above findings that the use of cloud computing can improve information practices within SMEs to enhance their competiveness in Accra-Tema metropolis and that the decision to adopt cloud services is influenced by issues associated with the management of information within a cloud environment. The issues are as a result of the fact that:

1. There is a perceived level of difficulty on the part of SMEs when it comes to the movement of data over a cloud platform. This is mainly because, cloud computing allows for more storage capacity than on normal computer platforms and therefore there is a fear that transferring data from the service provider's platform to their systems will come with difficulty.

2. Though cloud computing is highly available and data accessed from anywhere, SMEs are not convinced about the procedures employed by cloud service providers in handling and processing their data. They will therefore prefer service providers to make their data management procedures available to them.

3. Due to the sensitive nature of their work, SMEs attach great importance to their data. They are therefore very conscious of the security measures service providers have put in place to protect their data. They also feel that they own the data and need to have control over it at all times. They expect service providers to offer them some level of control.

6.6.4 Elements from Findings Key for Framework

From the findings obtained for the first sub-research question, some key elements add value to the formulation of the proposed framework. These elements include:

1. Data security

2. Data availability

3. Data accessibility

4. Data storage

5. Data transfer

With the findings of information management discussed, the next section discusses the findings on cloud computing adoption drivers and benefits.

6.7 Findings: Adoption Drivers and Benefits

A central theme of this research project has to do with what cloud computing is and how its adoption can improve SME operations. For this reason, the respondents' knowledge of cloud computing and what drives them to adopt and their approach to the adoption process was sought. An in-depth discussion of the findings in relation to this follows.

6.7.1 Questionnaire Findings

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 three questions regarding Internet usage, Internet security breaches and the level of breaches.

The respondents' different ways of using the Internet are presented in table 6.18 below. Responses total more than the 261 respondents as multiple responses were allowed.

Table 6.18: Summary of different ways of using Internet by Respondents

Ways Internet has been Adopted	Number of Respondents using this kind of services	Percentage (%) of Responses	Percentage (%) of Respondents
Web-based email	219	57.94	83.91
Research	43	11.38	16.48
Running web application	37	9.79	14.18
Intranet	32	8.47	12.26
Advertising on social media	14	3.70	5.36
Hosting products and services	12	3.17	4.59
Storage	9	2.38	3.45
E-commerce	8	2.12	3.07
Video conferencing	4	1.06	1.53
Totals	**378**	**100.00**	**132.57**

The findings show that most respondents 219 (219 which is 83.91%) have adopted the Internet for their email services. Others indicated the use of the Internet for carrying out research (43 which is 16.48%), running their web-applications (37 which is 14.18%) and intranet services (32 which is 12.26%). Only a few SMEs (4 which is 1.53%) used the Internet for their video conferencing needs, with similar responses recorded for storage (9 which is 3.45%) and e-commerce services (8 which is 3.07%).

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 operations. The results are presented in table 6.19.

Table 6.19 Frequency of Internet Security Breaches

Internet Security Breach	Number of Respondents	Percentage (%)
Yes	23	8.81
No	238	91.19
Totals	**261**	**100.00**

The results from the table indicate that the majority of respondents 238 (91.19%) have not experienced any security breach in their use of the Internet compared to 23 (8.81%) who have experienced some form of Internet security breach.

Respondents were therefore asked about the seriousness of the Internet security breach. The seriousness of Internet security threat is related to how concerned IT security professionals are with each threat. The seriousness level of an Internet security breach is an indication of the importance of the threat to SMEs. In the context of the current study, a minor Internet security threat is when the threat is considered less serious. However, when the threat causes considerable damage to assets it is assumed to be moderate threat. When it causes a significant damage to assets, it is a major damage. The responses are presented in table 6.20.

Table 6.20: Seriousness of Internet Security Breach

Seriousness of Security Breach	Number of Respondents	Percentage (%)
Major	4	17.39
Moderate	8	34.78
Minor	11	47.83
Totals	**23**	**100.00**

The majority of SMEs (11 which is 47.83%) have experienced minor threats from intruders while (8 which is 34.78%) experienced a rather moderate threat using the Internet. Only (4 which is 17.39%) regarded the threat of intruders gaining access to their online business information as a major threat.

Respondents were further asked about their familiarity and usage of the technology in question, namely cloud computing. This question provides a complementary view of the respondent's knowledge and understanding of this Internet-based technology. Respondents were asked to indicate which of the pre-defined cloud based applications they are not familiar with. The options provided for response in this list were obtained through literature review. It must be noted again that the total number of respondents for all application is more than 261 as each of the respondents could tick multiple applications, and these responses are in Table 6.21.

Table 6.21: Summary of Pre-defined Cloud-based Applications not Familiar to Respondents

Cloud-Based Applications	Number of Respondents Not Familiar with Application	Percentage (%) of Responses	Percentage (%) of Respondents
Google Apps	73	9.86	27.97
Facebook	0	0.00	0.00
Gmail	0	0.00	0.00
Skype	43	5.81	16.48
Yahoo mail	0	0.00	0.00

LinkedIn	13	1.76	4.98
Twitter	62	8.38	23.75
PayPal	184	24.86	70.50
Hotmail	5	0.68	1.92
Flickr	150	20.27	57.47
Microsoft Office 365	115	15.54	44.06
Dropbox	34	4.59	13.03
Microsoft Security Essentials	61	8.24	23.37
Totals	**740**	**100.00**	**283.53**

From Table 6.21, the least known cloud based applications were PayPal 184 (70.50%), Flickr 150 (57.47%) and Microsoft Office 365 115 (44.06%). However, all respondents were familiar with Facebook and web-based email like Gmail, Yahoo mail.

Furthermore, respondents were asked to indicate which of the applications they are currently using and those they are not using. These responses were reported as number of respondents who were familiar with and may not necessarily be using the listed cloud base application, and those currently being used. These are shown in Table 6.22 and 6.23 respectively.

Table 6.22: Summary of Pre-defined Cloud-Based Application Familiar but Not Used by Respondents

Cloud-Based Applications	Number of Respondents Familiar with But Not Using the Application	Percentage (%) of Responses	Percentage (%) of Respondents
Google Apps	39	3.31	14.94
Facebook	44	3.73	16.86
Gmail	101	8.57	38.70
Skype	89	7.55	34.10
Yahoo mail	147	12.47	56.32
LinkedIn	20	1.70	7.66
Twitter	140	11.87	53.64
PayPal	64	5.43	24.52
Hotmail	150	12.72	57.47
Flickr	96	8.14	36.78
Microsoft Office 365	89	7.55	34.10
Dropbox	65	5.51	24.90
Microsoft Security Essentials	135	11.45	51.72
Totals	**1179**	**100.0**	**451.71**

Though familiar with web-based email 147 (56.32%) and 150 (57.47%) are not using web-emails like yahoo and Hotmail respectively. SMEs (44 which is 16.86%) and (140 which is 53.64%) were not using social networks such as Facebook and Twitter respectively even though they are familiar with the service.

Table 6.23: Summary of Pre-defined Cloud-Based Application Usage

Cloud-Based Applications	Number of Respondents Familiar with and Using the Application	Percentage (%) of Responses	Percentage (%) of Respondents
Google Apps	149	10.11	57.09
Facebook	217	14.72	83.14
Gmail	160	10.85	61.30
Skype	129	8.75	49.43
Yahoo mail	114	7.73	43.68
LinkedIn	228	15.47	87.36
Twitter	59	4.00	22.61
PayPal	13	0.88	4.98
Hotmail	106	7.19	40.61
Flickr	15	1.02	5.75
Microsoft Office 365	57	3.87	21.84
Dropbox	162	11.00	62.07
Microsoft Security Essentials	65	4.41	24.90
Totals	**1474**	**100.0**	**564.76**

The most common cloud-based applications currently used are LinkedIn, Facebook and Dropbox. They recorded 228 (which 87.36%), 217 (which is 83.14%) and 162 (which is 62.07%) respectively.

Cloud computing is a new model of computing that offers opportunities to SMEs, technologies available to their larger counterparts to help create the needed innovativeness, and increase competitiveness. However, because cloud computing is a new innovation, it requires a complete changeover of the current IT system of businesses. Respondents were asked questions about their willingness to adopt and the availability of resources to carry out a successful adoption and use of cloud computing. The result is shown in Table 6.24

Table 6.24: Willingness to Adopt Cloud Computing

Willingness to Adopt	Number of Respondents	Percentage (%)
Yes	247	94.64
No	14	5.36
Totals	**261**	**100.0**

It was impressive that almost all respondents 247 (94.6%) indicated their willingness to adopt and use cloud computing. However the decision to adopt new technologies is subject to the availability of resources. Findings relating to resources are represented in Table 6.25.

Table 6.25: Availability of Resources for Cloud computing Adoption

	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq. / %
Resource Availability	80	30.65	166	63.60	0	0.00	15	5.75	0	0.00	261 / 100
Lack of Resources for training IT personnel	30	11.49	68	26.05	22	8.43	111	42.53	30	11.49	261 / 100
Lack of resources for implementing new technologies	0	0.00	89	34.10	32	12.26	99	37.93	41	15.71	261 / 100

Majority of the SMEs (246 which is 94.25%) disagree to the fact that they have enough resources available in general. This lack of resources has led to a situation where SMEs (140 which is 53.64%) are unable to acquire the needed resources to implement new technologies. This has also affected SME's (141 which is 50.02%) ability to train people to manage their already existing IT infrastructure.

Despite all these issues relating to resources and their subsequent effect on adoption, cloud computing offers numerous benefits that serve as driving factors for the adoption. Respondents were asked to indicate how certain factors drive them to adopt cloud services. The following driving factors were derived from the questions: flexibility, agility, innovative business environment, cost reduction, reduced IT staff, efficiency, ease of work, increased productivity, easier accessibility of software and reduced system administration. These drivers were rated on a Likert Scale which ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). Table 6.26 displays the results that were obtained from the questions.

Table 36.26: Cloud Computing Adoption Drivers

	Motivator	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total
		Freq.	%	Freq.	%	Freq	%	Freq.	%	Freq.	%	Freq. / %
1	Flexibility	0	0.00	12	4.60	65	24.90	143	54.79	41	15.71	261 / 100
2	Agility	0	0.00	5	1.92	92	35.25	123	47.13	41	15.71	261 / 100
3	Innovative business environment	0	0.00	5	1.92	50	19.16	165	63.22	41	15.71	261 / 100
4	Cost reduction	0	0.00	0	0.00	52	19.92	175	67.05	34	13.03	261 / 100
5	Reduced IT staff	0	0.00	0	0.00	42	16.09	164	62.84	55	21.07	261 / 100
6	Efficiency	0	0.00	4	1.53	65	24.90	157	60.15	35	13.41	261 / 100

7	Ease of work	5	1.92	67	25.67	146	55.94	43	16.48	0	0.00	261/100
8	Increased productivity	0	0.00	3	1.15	142	54.41	95	36.40	21	8.05	261/100
9	Easier accessibility of software	6	2.30	7	2.68	51	19.54	154	59.00	43	16.48	261/100
10	Reduced system administration	3	1.15	4	1.53	59	22.61	164	62.84	31	11.88	261/100

SMEs generally agree that factors indicated in Table 6.26 drive them to adopt cloud computing services. However, some factors were rated high over others. SMEs indicated they are highly motivated to adopt cloud computing services because of cost reduction (209 which is 80.08%), reduced IT staff (219 which is 83.91%), efficiency (192 which is 73.56%), software accessibility (197 which is 75.48%), reduced system administration (195 which is 74.72%) and flexibility (184 which is 70.50%). A significant number of SMEs 146 (which is 55.94%), 142 (which is 54.41%) and 92 (which is 35.25%) were uncertain about the effect of cloud computing on easing their work, increasing their productivity and making them agile respectively.

6.7.2 Interview Findings

Categories are described by Corbin and Strauss (2008) as being higher-order ideas that bring together, and explain, a group of ideas. The idea derived from the analysis of the interview guide was organized into four categories, which were (1) adoption strategy, (2) adoption considerations, (3) adoption drivers, and (4) benefits of cloud computing.

6.7.2.1 Adoption Strategy

Cloud computing adoption strategy is the creation of a better understanding of a business and identifying how they can adopt the technology. It aims to help businesses obtain measurable benefits after adoption. This includes knowing your business goals and the technological infrastructure to help achieve those goals, identifying business applications to move to the cloud, and establishing a roadmap to allow you to adopt cloud computing with measurable benefits.

In the current study, participants were required give to provide the strategies they have put in place as far as the adoption and usage of cloud computing is concern. The subcategories that were evident include adoption goal, adoption roadmap and adoption expectations, which are discussed below.

6.7.2.1.1 Adoption Goal

In a dynamic business environment, businesses are under pressure to innovate and adapt to new challenges in their operations. They need to adopt new technologies, be more connected and make use of mobile devices in the workplace. Adopters (G1-G4) adopted cloud computing to serve their various business interests. The nature of their work *"requires that everything is done online and also that they have access to information anytime and from everywhere"* (G1). Some participants started their operation in the cloud and most of their business tools and service are cloud-based (G1, G2, G3). For an adopter (G4), there was the need to integrate their business to a platform that will ensure they are highly available and cloud computing was the best alternative for them.

Though they have not yet adopted, prospectors hope to see differences in their operation when they eventually adopt cloud computing. Prospectors (G5-G9) consistently mentioned the fact that they hope to adopt cloud computing to enable them to store more data. *"We hope to get most of our data up there and also helping us to be able to store more data up, where we can access them wherever we are"* (G6). G9 added: *"......which will prevent us from having physical facilities where we have to store data and it will be a good disaster recovery plan".*

Cloud computing is new to non-adopters and as such, they have no immediate adoption plans. However, upon knowing what the technology stands for, they were quick to state what their adoption goals are if they decide to adopt. Cloud computing will serve as a platform for backing up their information should there be any internal disaster (G10) and to ease their workload (G11).

6.7.2.1.2 Adoption Roadmap

Cloud computing is not a specific invention or set of technologies. Cloud computing is uniquely used in every organization and therefore the approach to adopting cloud computing is unique for every enterprise. As a result, a one-size-fits-all roadmap to cloud adoption is not possible. There is therefore the need for individual businesses to have their own adoption roadmap to ensure a successful adoption. A roadmap provides guidance to the cloud adoption efforts, allowing multiple projects to progress in parallel yet remain coordinated in pursuit of a common target that provides value greater than the sum of the individual projects (Mattoon, 2013). The researcher sought to find out if participants had any form of roadmap to guide them in their quest to adopt cloud services. Elements of the roadmap include adoption time frame, functions, resources and business applications, and these are discussed further below.

Adoption Time Frame

Adopters were found to have either started their operation in the cloud*: "......so from inception, we were using cloud computing"* (G3) or have adopted cloud services for some time now: *"We have already moved to the cloud for about a year now"* (G4) and therefore did not have any clear adoption strategy especially on the expected time frame of adoption.

Prospectors however stated a fixed time to migrate to the cloud: *"Within the first quarter of 2015, we hope to move to the cloud"* (G9). Another said*, "We hope to move between 2 to 3 years"* (G7). On the contrary, non-adopters had no clear time frame for migration. A non-adopter commented *"This is the first time we are getting to know so it is very new to us and therefore no firm decision has been taken"* (G11)

Functions

Though not all businesses have a clear time for adoption, they expect this new technology to perform some functions that is well beyond what their existing technologies deliver. Adopters trusted the cloud to perform some needed functions as part of their operation and this led to them adopting it in the first place. This is evident from what G1 stated: *"The nature of our work requires that everything is done online".* A similar observation was also made by G2: *"We are already in the cloud. For now, I will say our needs are being met by the cloud"*. Businesses ideally want to operate the entire business with minimum infrastructure footprint on their premises. Cloud integration strategy is therefore a key aspect to be considered for SME applications which are hosted and planned in the cloud. This view was shared by G3: *"We have thought of how to integrate our business applications with the cloud platform"*. Another corroborated this by saying: *"We hope to adopt before the end of the year. As I mention, storage and collaboration. How to collaborate with our business application"* (G6).

According to the data gathered from the interviews (G1-G11), being able to integrate their hosted business applications with what the cloud platform has to offer was found to be an important parameter for businesses. They believe that this will free them from building and maintaining IT infrastructure so they can focus on value-creating differentiation to run over that infrastructure. As G4 stated *"With our applications running in the cloud, I am able to focus on other things than managing the physical aspect of the IT work".* For SMEs, using cloud computing may be attractive, because it can help them focus on their core business process.

Resources

Cloud computing provides affordable IT solutions to enterprises to help them improve their IT related capabilities and empower them to be competitive. However, these enterprises are often constrained by limited resources. The decision to adopt and use cloud computing is therefore determined by the availability of resources. The data from the interview indicates that prospector and non-adopter SMEs had enough financial resources to move to the cloud.

However, all participants (G1-G11) complained of issues relating to either human resource, infrastructural resource or both. SMEs often do not have sufficient human resources and skills to adopt new technologies (Wanjau et al., 2012). An adopter participant commented: *"We didn't have human resource and had to train people to use the cloud service because it was something new altogether"* (G4). Similarly, a prospector stated: *"For capital resources, we have but for human resources, we may need training"* (G6). G09 corroborated: *"We are making plans to re-enforce our resources in terms of skills and equipment"*.

A non-adopter participant who had hope of moving to the cloud in future also commented: *"For personnel, as I said, we will be getting new people"* (G11). Therefore, the level of skills available to SMEs and ways in which these skills are acquired are of great importance to ensure a successful adoption of cloud services.

Business Applications

Cloud-based applications are usually up and running in days and they cost less. With a cloud-based application, users just open a browser, log in, customize the application, and start using it. Enterprises are therefore moving their applications to the cloud to enjoy the offerings it provides.

Adopters (G1-G3) are software developers and started their operation straight from the cloud. Most of their business tools and services for development are on the cloud platform from the service provider as indicated by G1: *"Business process application is what we are pushing for",* and they "*try to integrate our business applications with the cloud platform*" (G3). G4 adopted the cloud to allow them to unify the operations of the enterprise in terms of IT and are currently using office 365, and a standard operating system from the cloud.

For prospectors (G5-G9), the nature of their work requires them to have their critical business support system available at all times. They therefore intend to adopt an enterprise resource planning (ERP) system, such as: SAP: (G5, G8, G9) and office 365 (G6) and storage infrastructure to store their information (G7, G8) when they move to the cloud.

For future consideration, non-adopter (G10) stated: *"We are using tally, accounting software and I hope cloud computing will help in that area"*. G11 added: *"For business application, simple accounting software like sage, pastel and excel is what we hope for"*. Businesses therefore have to rigorously test the security and reliability of a service provider's infrastructure and adopt the necessary application to improve their operation.

6.7.2.1.3 Adoption Expectations

To stay relevant, IT departments are expected to play a stronger role to support strategic initiatives to grow the business, support innovation and improve customer experience (Cisco, 2013) through the use of new technologies. The researcher wanted to find out what cloud computing means to participants and what they hope to establish from the cloud.

From the responses, SMEs who have adopted cloud-based services have already established a lot and cannot exist without cloud computing. One adopter stated: *"Well cloud computing means everything to us. I will say about 80% of our services is done in the cloud. The reason is because of the reliability of base infrastructure here in Ghana. We have a service that run 24 seven, we don't have a stable electricity; it is actually more expensive to host our services here in Ghana than it is to host in the cloud. So it is not what we hope to establish, we have established a lot"* (G2). Another adopter also stated: *"Our business needs to be highly available, so from the inception, we were using cloud computing. That is where we host our service. So we started straight from the cloud"* (G3). It is evident that participants adopted cloud computing to sustain their operation, achieve cost reduction in their operation, reliability, and availability. G1 and G4 also stated cost effectiveness and availability as what they have established from the cloud.

Meanwhile, prospector participants who have not adopted, have high expectations from the cloud when adopted. As G8 stated *"Cost reduction as the upfront cost of spending on IT will be eliminated and accessibility as computing resources can be accessed from anywhere".* Another concurs and stated: *"Well it is cost effective"* (G9). The issue of cost effectiveness, availability, flexibility, technical support and efficiency appeared in the responses from the remaining prospector participants. Participants (G6 and G7) also mentioned the capacity to store enough data in the cloud: *"We hope to get most of data up there and also helping us to be able to store more data"* (G6).

Since they have not adopted and know very little about cloud services, one non-adopter stated*: "Seriously, we have not even considered cloud computing"* (G10). However, G11 was very optimistic and stated*: ".....when we join cloud computing, it will help us access information fast. At the same time, it will also save time"* (G11).

Businesses stand to gain from adopting cloud computing. According to Miller (2008), cloud computing offer a lot of advantages in the areas of capacity, reliability, and flexibility. Participants perceived cloud computing services as a cost-effective approach to computing. It reduces the cost of accessing a vast pool of computing resources for a relatively short amount of time (Marston *et al.,* 2011). Therefore when businesses are exposed to the benefits of using cloud computing, it will help raise awareness leading to a successful adoption.

6.7.2.2 Adoption Considerations

Cloud computing offers affordable IT resources which create opportunities for businesses to improve their IT-related capabilities and empower them to be more competitive in global markets. Despite these advantages, the adoption rate of cloud computing adoption by businesses is not as fast as expected (Buyya, Yeo, Venugopal & Brandic, 2009), sometimes due to the lack of consideration of the approach. These factors regarding the adoption and implementation of cloud computing need careful consideration.

When moving services and applications to the cloud, users need to decide what type of cloud environment will work for their business. Cloud computing solutions can be approached either privately, publicly, or as a hybrid (Buyya, Broberg & Goscinski, 2011). It is therefore important to know what approach to cloud computing SMEs are taking to realise their goals. Participants had varying reasons for going for a particular cloud environment. Participants (G4, G7, G9 and G10) are interested in a private cloud approach and attributed this to the sensitive nature of their work and security concerns in other environments. They feel private cloud offers a more robust platform.

G7 stated: *"I think private cloud will do. Because of the sensitivity of our job, throwing this on say a public platform, the risk involved will be quite higher compared to private".* G10 agreed: *"Private cloud. Because we are not so sure how safe our information will be in a public and hybrid. Our data is expensive, so we wouldn't mind spending to get a private cloud just to protect our data".* They find it worth the investment to virtualize their internal infrastructure since the private cloud offers much higher levels of control, security and availability. Participants (G3, G8 and G11) opted to approach the cloud through the public cloud model. From the responses, participants feel the shared and utility nature of a public cloud helps to reduce cost, since SMEs by their small size operate with limited capital.

The main purpose of adopting cloud computing is to score economic gains (IDC, 2009). G3 commented*: "We have looked at private and hybrid cloud but our business size does not recommend those options. So public cloud for now is where we are".* This is consistent with Goode and Stevens (2001), who found that the adoption of technology is influenced by the size of the business. They were of the view that private and public clouds are tuned for large businesses and that their resource utilization is not at a level to sign up for such cloud services. Participants (G1, G2, G5 and G6) indicated they are pushing for hybrid cloud because of the complex nature of what they put in the cloud. According to G2, *"Sometimes* *we have portions of our work that may require us to be in the private and portions that reside in the public"*. Hybrid cloud offers businesses the opportunity to maximize efficiencies by using a public cloud for non-sensitive operations and private where required (Intega, 2014). For SMEs, the decision for a type of cloud environment is strongly influenced by the services, storage, collaboration and applications they intend to move to the cloud.

6.7.3 Findings: Adoption Benefits

The study aims to investigate the required factors for a framework to support cloud computing adoption. As such, careful consideration must be made before any decision is made regarding the acceptance, adoption and usage of cloud services to ensure a successful adoption process. Strategic, technical and economic benefits of cloud computing motivate businesses to adopt it (Rio-Belver, Cilleruelo, Garechana, Gavilanes & Zabalza, 2012).

6.7.3.1 Adoption Benefits from Literature and Interviews

Respondents were asked to explain how the adoption benefit literature influences their operation. Some of the responses provided are presented below. The findings from literature were matched to interview responses.

6.7.3.1.1 Cost Reduction

SMEs by their nature operate with limited capital. They are therefore under intense pressure to cut costs without undercutting critical services. In this study, all participants perceived cloud computing services as a cost-effective approach to computing. According to IDC (2009), cloud computing is adopted to score economic gains. For adopters, cost is a motivating factor when they compare cloud services to the traditional way of computing, where they spent so much to purchase their IT infrastructure and resources to manage the infrastructure. As G3 states, *"With cloud computing, you have all these established for you at a minimal price and already have the resource to manage it for you. So it is cost-effective".* They feel the cost of consuming resources in a cloud environment is greatly reduced. Participants (G5, G6, G8-G11) were emphatic that when they adopt cloud services, their operational expenditure will be reduced mostly by way of purchases of gadgets and maintenance costs. These cost-related benefits positively influence the adoption of cloud computing (Tan and Lin, 2012, Borgman, Bahli, Heier & Schewski, 2013). However, G7 was mindful of the initial cost component of moving to the cloud*: "Cost will not prevent us from moving to the cloud. The functionality it provides matches the costs. It is cost effective".* Therefore, cloud computing can be seen as a chance to enable SMEs to reduce the cost of their IT operations.

6.7.3.1.2 Ease of Setup

Cloud computing is a utility computing and therefore for businesses, there is the elimination of having to physically setup IT infrastructure on their premises. According to adopters (G1-G4), cloud computing does not require much initial setup. Most of the setup is done by the service provider and service made available to them as a click event. Prospectors (G5, G8, G9) expressed similar views. As cloud computing is delivered as a service, they expect the service provider to do all the setting up. This is reflected in the answer by G9*: "The fact that it is a service means you don't have to do any setup yourself"*. However, for G6, G7 and non-adopters (G10, G11), even though they expect the provider to do most of the setup, they still feel they will need to do some setting themselves.

6.7.3.1.3 Agility

The increasing need for higher business agility is a key motivator in the growing interest in cloud computing. It offers businesses the computing agility needed to be responsive to changing user requirements (Marston *et al.,* 2011). The response obtained from adopter respondents indicated cloud computing makes their businesses agile. The fact that service providers are able to meet their request at anytime and anywhere, make a business case for cloud computing. They are able to make continuous incremental changes and adjustments in their operation and as a result respond to new business conditions as they unfold. G2 responded in relation to this: *"If the provider is responsive to your request, it aids agility".* For prospectors and non-adopters, they expect a service that will allow them to make changes as and when they want in order to outperform their competitors. As G8 puts it, *"The fact that information can be accessed or settings can be done at one point remotely and reflects across the network gives you a lot of agility in terms of making updates, changes, corrections and so on".* For SMEs, the agility and ability to respond to changing business demands is obviously not a just a technology question but rather, technology is an enabler of it.

6.7.3.1.4 Ease of Use and Administration

Cloud services offer significantly easier system administration. User interfaces are also user friendly compared to traditional software (KPMG, 2011), and users only need web browsers or other simple client applications in order to access the numerous applications provided. Service providers make available special management tools which users can easily use to provision services. Adopters (G1-G4) admitted that cloud computing makes it easier to access software and reduces system administration. Enterprises tend to use cloud computing if there is no need for advanced technical skills and greater efforts (Borgman *et* *al.,* 2013). They are able to provision as many instances of a service as they want and can easily delete them with a click and according to G3*: "This will be difficult to do in a physical setup".* Some adopters also added that initially it was a bit confusing using the service because it was new. For prospectors and non-adopters (G5-G11), they expected the using and administration of cloud services to be smooth soon after adoption. They were however of the view that the initial stages of adoption and usage will be difficult since they do not have personnel with enough knowledge in cloud computing. G7 gave a reflective comment: *"I think once it is setup and everyone has undergone training...........there will be a smooth administration".* Organisations require resources to maintain visibility in all parts of infrastructure, whether that infrastructure is in the cloud or not (Ross, 2013).

6.7.3.1.5 Relative Advantage

Firms are more likely to adopt a particular innovation when they consider it as relatively advantageous over an existing one (Lee, 2004). As a result, SMEs need to have a clear understanding of the relative advantages of using cloud services. Adopters (G1-G4) were very much aware of the benefits of cloud-based services. Prospectors (G5-G9) and non-adopters (G10-G11) perceived cloud computing to be relatively advantageous over traditional IT setups (G9) and attributed their late adoption to the lack of awareness of these services (G11). They stated their commitment to adopting cloud computing because of the expectation of achieving flexibility (G6), mobility (G5) and reduce their IT expenditure (G7, G8, G10, G11). These technical and economic advantages are compelling enough for them to move to the cloud.

The above mentioned adoption benefits are pre-defined benefits from literature. Participants were therefore asked to indicate the benefits they expect from cloud computing. The findings are discussed below.

6.7.3.2 Adoption Benefits from SME Interviews

Firms often adopt the different cloud computing deployment and delivery models to score economic benefits on hardware, software, maintenance and backups. These economic benefits have a positive influence on cloud computing adoption (Tan and Lin, 2012, Borgman et al., 2013). For adopter participants, adopting cloud-based solutions has brought savings and operational efficiency (G1, G4) and also the needed availability and support (G2, G3). They stated the availability of services ensures a high up-time and the ability to scale up and down depending on the volume of work. Prospectors expect a reduced cost in their processes (G5, G6, G7, G8), accessibility and availability of resources (G8, G9), and reduced manpower to manage internally installed software. For non-adopters (G10, G11), they expect to reduce their expenditure on hardware and backups. These perceived benefits have a positive influence on adoption. The interview responses further affirm the fact that, several key adoption considerations are expected to be factored into the decision to adopt cloud computing to ensure a successful adoption process within SMEs.

6.7.4 Summary of Findings on Cloud Computing Adoption Drivers and Benefits

The findings from the interviews indicate that the adoption framework should discuss critical adoption factors that would address the various technical and social considerations that are necessary to create conditions conducive for adoption. From the findings, some of the factors worth considering in an adoption framework are:

1. Though most SMEs surveyed are familiar with cloud-based applications only a few are using them currently. SMEs are however willing to adopt cloud-based services depending on the availability of resources and they hope to adopt to serve their specific business needs. The SMEs surveyed have some experience using the Internet and some have encountered some sort of security breach, thereby affecting their decision to adopt since cloud computing is an Internet-based technology.

2. To ensure a successful cloud computing adoption, the framework must include an adoption strategy, adoption considerations, adoption motivators and benefits of cloud computing. For SMEs to better understand and identify how they can adopt cloud computing, they need an adoption strategy. The adoption strategy should include the adoption goal, adoption roadmap and adoption expectations.

3. Cloud computing is uniquely used by every SME and as such different adoption roadmaps exist for different SMEs. However, for the surveyed SMEs common elements that featured in their roadmap are time frame for adoption, whether the functions of the services fits their business needs, and the availability of resources to adopt and manage cloud services.

4. Despite the advantages of using a cloud-based service, its adoption is slow because there is often the lack of consideration of the approach to adoption and the legal compliance requirement of the whole process. SMEs mentioned their approach to the cloud as either private, public or hybrid depending on the nature of their work and the availability of resources. They also acknowledge the fact that since cloud computing is offered as a service, there are legalities they try to understand before using the service.

5. Factors such as functionality, agility, innovative business environment, transformation of capital expenses to operational expenses, reduced IT staff, minimal initial capital investment, efficiency, ease of work, increased productivity, easier accessibility of software, and reduced system administration were found to motivate SMEs to move to the cloud.

6. SMEs expect cloud computing to play a stronger role to support more strategic initiatives to grow their businesses and improve customer experience. The benefits of cloud computing have a positive influence on the decision to adopt. SMEs surveyed indicated that they adopt cloud computing to score economic benefits on hardware, software, maintenance, uptime, and backups. Others adopt because cloud services are highly available, accessible and scalable.

From the preceding discussion, we may therefore conclude that several factors must be considered in a framework to support the adoption of cloud computing by SMEs in Accra-Tema metropolis of Ghana.

6.7.5 Elements from Findings Key for Framework

The findings for this sub-research question identified certain factors essential for the development of the proposed adoption framework. Firstly, the findings identified that participants are motivated to adopt and use cloud computing services as a result of:

1. Agility

29. Functionality

2. Efficiency

3. Cost reduction

4. Accessibility

5. Reduced IT staff

6. Ease of use/administration

The findings also revealed participants tend to adopt a technology when they stand to benefit. Some of the benefits SMEs identified are:

1. Maintenance/support

2. Automatic backups

3. Reduced expenditure on software
4. Reduced expenditure on hardware

These key factors will be discussed in detail in the next chapter. Having presented the findings to address the cloud adoption factors, the next section tackles the findings addressing adoption concerns and barriers.

6.8 Findings: Adoption Concerns and Barriers

The study aims to investigate the stumbling blocks for SMEs when they decide to adopt cloud computing as a competitive tool. Questionnaires and interviews were used to address this and an in-depth discussion of the outcome now follows, beginning with the questionnaire results. Respondents were asked to state and explain some of the concerns and barriers they associate with the adoption of cloud computing. Some of the responses provided are presented below.

6.8.1 Questionnaire Findings

As a new technology, cloud computing adoption is hemmed in fear, uncertainties, and concerns. There is therefore the need to find out some of the adoption concerns surrounding the adoption of the technology. Respondents were asked a series of questions derived from the literature review that borders around adoption concerns. The responses were measured on the Likert Scale which ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). The results are reported in Table 6.27.

Table 6.27: Cloud adoption concerns

	Adoption concerns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq. / %
1	Loss of control of information	0	0.00	11	4.21	53	20.31	142	54.41	55	21.07	261 / 100
2	Secure authentication, user credentials and role management under control of provider	0	0.00	10	3.83	33	12.64	196	75.20	22	8.43	261 / 100
3	Integration	9	3.45	26	9.96	29	11.11	171	65.52	26	9.96	261 / 100
4	Compatibility	9	3.45	36	13.79	47	18.00	160	61.30	9	3.45	261 / 100
5	Privacy	0	0.00	11	4.21	39	14.94	196	75.20	15	5.75	261 / 100
6	Data lock-in	7	2.68	51	19.54	58	22.22	137	52.49	8	3.07	261 / 100

7	Perceived complexity	16	6.13	12	4.60	74	28.35	132	50.57	27	10.34	261/100
8	Security	6	2.30	6	2.30	24	9.20	208	79.69	17	6.51	261/100

From Table 6.27, it was seen that SMEs have concerns when it comes to the adoption of cloud computing. Most respondents surveyed (197 which is 75.51%) and (218 which is 83.63%) respectively were of the view that they stand to lose control over their data whiles in the cloud and including user authentication and rights to the service provider. SMEs indicated leaving their data in the care of another person has security (225 which is 86.20%) and privacy (211 which is 80.95%) concerns.

Respondents hope to integrate cloud computing with their current IT infrastructure. However, (197 which is 75.48%) of respondents indicated they feared cloud computing services may not work properly when they try to integrate with their existing infrastructure.

6.8.2 Interview Findings: Adoption Concerns

While the benefits of cloud computing are important, so is the complexity of planning, building and using a cloud service. Enterprises and service providers have been slower to adopt cloud-based services due to concerns about control, privacy, security, confidentiality, integrity and availability, and how to address them. Respondents were asked questions relating to these pre-determined cloud adoption concerns and how they influence their decision to adopt. Cloud computing adoption barriers were also investigated.

6.8.2.1 Control

Due to the off-premises nature of cloud computing, it is perceived that enterprises may lose the control over their data. Although the concerns 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 (Rajan & Shanmugapriyaa, 2012).

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 Morgan and Conboy (2013), 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.

6.8.2.2 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 Morgan and Conboy (2013), 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 Ernst and Young (2011), 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 Borgmann, Hahn, Herfert, Kunz, Richter, Viebeg and Vowé, (2012) 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.

6.8.2.3 Confidentiality

SMEs expect their data and the cloud services they adopt to be confidential. Adopters (G1-G4) expressed their satisfaction about controls and validation criteria put in place by service providers to ensure their data is kept confidential. Prospectors and non-adopters (G5-G11) are hopeful other parties in the cloud will not have unauthorised access to their data due to the sensitive nature of the information. G7 commented: *"We are doing this job for the government and most of this information is confidential. So we really don't need this information being intercepted".* Service providers must therefore put measures in place to help secure user data to ensure trust among users.

6.8.2.4 Integrity

Cloud services are delivered over the Internet which according to G2: *".....Is essentially an ungoverned space".* Adopter participants (G1-G4) expressed the potential risk of sabotage either through data destruction or services being disrupted intentionally by other parties or even service providers. Prospectors (G5-G9) expressed similar views and mentioned the fear of hackers and intruders intercepting their information during transmission over the Internet.

Adopters (G1-G4) and prospector (G6, G8) tend to engage the services of multiple providers so that one will serve as a backup in case of any data destruction from one provider. Additionally, G2 has another backup strategy. This is reflective of the answer by G2: *"We have two major backups; one that run the service provider and another where we download at intervals, our data on to our local storage. Now as far as the potential of infiltration is concern, we run some permutation set with the provider".* Prospector (G7, G9) hope to revise the contract with the provider about the deliverables and perform regular integrity checks to make sure noting is altered.

6.8.2.5 Availability

The success or otherwise of cloud computing adoption is dependent on the availability of the resources on the respective platforms. Adopter participants (G1-G4) stated that cloud services from their providers have been highly available and they have not had any issue (at least from the side of the service provider) regarding that since they started using cloud-based services. The only time the service has not been available according to G1 and G3 has been when there is power outage or the Internet is down. This they say is common in the country.

Prospectors (G5-G9) claim they are hoping to adopt cloud computing because the services are always available and can be accessed from anywhere and anytime. However, the issue prospectors and non-adopters have has to do with Internet connectivity and power outages. G6 stated: *"In Ghana, we have Internet connectivity issues. So it is a concern because if you have put everything up there and there is no Internet?"* A non-adopter (G10) added*: "Power outages are even worse than Internet connectivity".* This implies Internet service providers need to offer reliable service and businesses need other alternative ways of keeping their power up at all times.

6.8.3 Findings: Adoption Barriers

Despite the numerous benefits cloud computing presents to businesses, cloud computing has its unique barriers associated with the adoption. Additionally, the adoption barriers change over time and may vary along the adoption path (Parida, Johansson, Ylinenpaa & Braunerhjelm, 2010). In this study, unreliable Internet connectivity, power outages, lack of knowledge and technical skills, and legal and regulatory uncertainty were cited as key cloud computing adoption barriers. The relevant interview findings relating to these barriers are described below.

6.8.3.1 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 (Uzoka et al., 2007).

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 is often unstable and slow bandwidths in developing economies like Ghana (Yeboah-Boateng & Essandoh, 2014), 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 (Veigas *et al.,* 2012). G5 and G6 hope to increase their bandwidth prior to the deployment of cloud-based services for easy access to resources in the cloud.

6.8.3.2 Power Outages

Though cloud computing is an affordable option for businesses to reduce costs involving electricity (Almunawar, Kang & Susanto, 2012), 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.

6.8.3.3 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.

6.8.3.4 Legal and Regulatory Uncertainty

According to Jalonen and Lehtonen (2011), 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 interviews give 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.

6.8.4 Summary of Findings on Cloud Computing Adoption Concerns and Barriers

The findings from both the questionnaire and interview indicate that SMEs are inhibited from adopting cloud computing because of several concerns and barriers associated with the technology. Some of the findings indicated that:

1. SMEs have a lot of concerns towards the adoption of cloud computing. They feel the hosting of resources on a third party infrastructure means they will lose control over those resources to the service provider. SMEs were concerned that cloud computing services may not integrate properly with their existing

infrastructure and may not be compatible with their business applications. For some SMEs, the evolving nature of cloud computing means the absence of fixed data privacy regulations which vary between countries. Also the open nature of the Internet means data communicated over it is highly vulnerable to attacks. SMEs indicated that they fear having their data locked-in on the platform of a provider should they decide to change that particular service provider. The perceived complexity of cloud computing was rejected by SMEs and they feel that using cloud computing will help reduce the work of system administrators.

2. They expect their service providers to put validation controls in place to help keep their data confidential. SMEs surveyed expressed a concern that 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 the transmission over the Internet. They therefore perform regular data checks to ensure the integrity of their data.

3. There are legal and regulatory uncertainties among respondents. The cross border movement of data has some legal implications since the laws of data protection in one country may differ from that of another country. SMEs therefore sign service level agreements (SLAs) with providers to ensure there is regulatory compliance on both sides.

4. SMEs indicated unreliable Internet connectivity, legal and regulatory uncertainties, lack of knowledge of cloud computing, and power outages as barriers that hinder their adoption of cloud computing as a business strategy. According to some SMEs, cloud computing is still a new innovation and therefore full of uncertainties especially when it comes to the legalities of moving data from one country to another. This, they claim, has affected the rate of adoption and is a contributory factor to their late adoption. 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 continue changing ISPs with the hope of getting one that will provide a reliable and uninterrupted Internet connection.

5. Due to its online nature, cloud computing requires a constant power supply. The frequent power outages experienced in the country is another factor that negatively affects adoption decisions. They feel that although generators can be installed to keep the power, not all SMEs can afford to run solely on generators. This is a major barrier to the adoption of cloud computing. 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. Additionally, 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.

The findings indicate therefore that several factors hinder SMEs from adopting cloud computing as a competitive tool.

6.8.5 Elements from Findings Key for Framework

The findings for this sub-research question produced certain concerns that influence the adoption process and hence the development of the proposed framework. These concerns include:

1. Data control
2. Integration
3. Confidentiality
4. Privacy concerns
5. Security concerns

The decision to adopt cloud services is further influenced by factors that inhibit their adoption. Such inhibitors according to the sampled SMEs include:

1. Connectivity
2. Legal and regulatory uncertainty
3. Power outages
4. Lack of Knowledge

6.9 Conclusion

This study seeks to investigate how the adoption of cloud computing can enhance competition among SMEs. In chapter one, the problem and its setting was identified. This was followed by the review of related literature on SME competitiveness and technology usage. Literature on the adoption of cloud computing was discussed in chapter 3 and was followed by the underlying theories on technology adoption in chapter 4. Chapter 5 discussed the appropriate research design and methodology used for this study and this chapter presented the empirical findings of the study. This section gives a summary of the research findings as presented in table 6.28 below to conclude this chapter.

Table 6.28 The Research Findings for the Study are Summarised Below (Source: Own Creation)

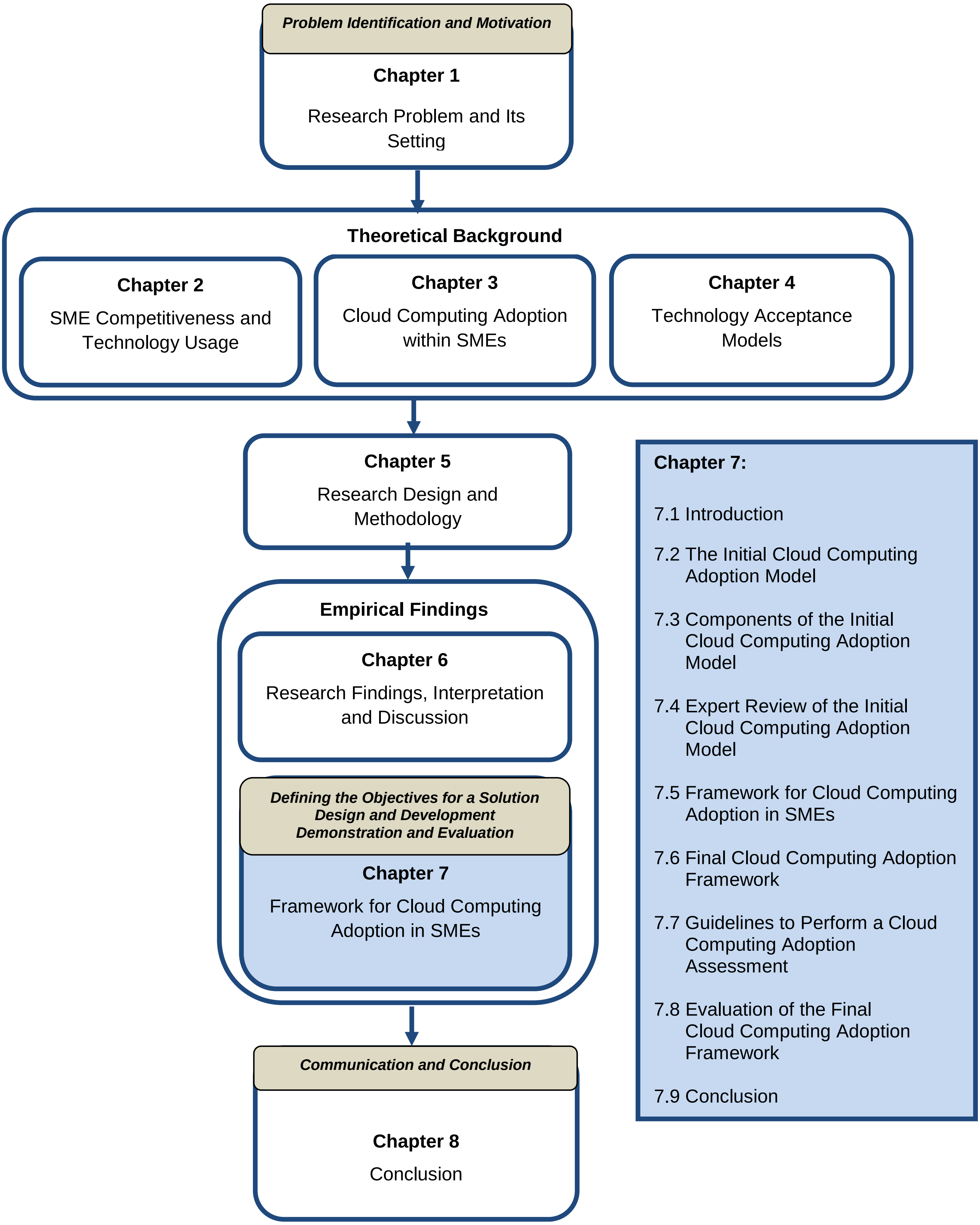
Theme	Summary of the Findings
Information Management Practices	A conclusion can be drawn from the findings that the use of cloud computing can improve information practices within SMEs to enhance their competiveness in the Accra-Tema metropolis and that the *decision to adopt cloud services is influenced by issues associated with the management of information within a cloud environment.* The issues are as a result of the fact that: • *There is a perceived level of difficulty on the part of SMEs when it comes to the transfer of data over a cloud platform.* This is mainly because, cloud computing allows for more storage capacity than on normal computer platforms and therefore *they fear that transferring data from the service provider's platform to their systems will come with difficulty.* • Though cloud computing is highly available and data accessed from anywhere, *SMEs are not convinced about the procedures employed by cloud service providers in handling and processing their data.* They will therefore *prefer providers to make available to them some of their data management procedures.* • Due to the sensitive nature of their work, SMEs attach great importance to their data. They are therefore very *conscious of the security measures service providers have put in place to protect their data* whilst in their care. *They also feel they own the data and need to have control over it at all times.* They expect service providers to *offer to them some level of control.*
Adoption drivers and benefits	The findings indicate that the adoption framework should discuss critical adoption variables that would address the various technical and social considerations that are necessary to create conditions conducive for encouraging the adoption of cloud computing by SMEs. Some of the factors that came up are: • SMEs are familiar with cloud-based applications, even though just a few are using them currently. They are however *willing to adopt cloud-based services depending on the availability of resources.* The adoption of cloud computing is to serve specific business needs. In their use of the Internet, *SMEs have encountered some level of security breach. This affects their decision to adopt Internet-based technologies like cloud computing.* • The framework must include an adoption strategy, adoption considerations, adoption drivers and benefits of cloud computing. • For SMEs to better understand and identify how they can adopt cloud computing, *they need an adoption strategy. The adoption strategy should include and adoption goal, adoption roadmap and adoption expectations.* • Cloud computing is uniquely used by every SME and as such *different adoption roadmaps exist for different SMEs*. However, for the surveyed SMEs *common elements that*

	featured in their roadmap are time frame for adoption, whether the functions of the services fits their business needs, and the availability of resources to adopt and manage cloud services. • There is often the lack of consideration for the approach to adoption and the legal compliance requirement of the whole process. *SMEs mentioned their approach to the cloud as either private, public or hybrid depending on the nature of their work and the availability of resources.* They also acknowledge the fact that since cloud computing is offered as a service, *there are legalities that they try to understand before using the service.* • *Factors such as functionality, agility, innovative business environment, transformation of capital expenses to operational expenses, reduced IT staff, minimal initial capital investment, efficiency, ease of work, increased productivity, easier accessibility of software, and reduced system administration were found to motivate SMEs to move to the cloud*. • SMEs expect cloud computing to play a stronger role to support more strategic initiatives to grow their businesses and improve customer experience. *The benefits of cloud computing have a positive influence on the decision to adopt.* SMEs surveyed indicated that they adopt cloud computing to *score economic benefits on hardware, software, maintenance, uptime and backups.* Others adopt because cloud services *are highly available, accessible and scalable.*
Adoption concerns and barriers	The findings from both the questionnaire and interview indicate that SMEs are inhibited from adopting cloud computing because of several concerns and barriers associated with the technology. Some of the findings indicated that: • SMEs feel the hosting of resources on a third party infrastructure means they will lose control over those resources to the service provider. • SMEs were concerned that cloud computing services may not integrate properly with their existing infrastructure and may not be compatible with their business applications. • For some SMEs, the evolving nature of cloud computing means the absence of fixed data privacy regulations which vary between countries. Also the open nature of the Internet means data communicated over it is highly vulnerable to attacks. • SMEs indicated that they *fear having their data locked-in on the platform of a provider* should they decide to change that particular service provider. • The perceived complexity of cloud computing was rejected by SMEs, who rather feel using cloud computing will help reduce the work of system administrators. • They expect their service providers to put control and validation controls in place to help keep their data confidential. • SMEs surveyed expressed as a concern that 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 the transmission over the Internet. They therefore perform regular data checks to ensure the integrity of their data. • SMEs indicated Internet connectivity, initial start-up cost, lack of knowledge of cloud computing, power outages,

	uncertainty, and low level of awareness as some of the factors that concerns them and hinder their adoption of cloud computing as a business strategy. According to some SMEs, *cloud computing is still a new innovation and the level of awareness in the country is low.* This they claim has affected the rate of adoption and *a contributory factor to their late adoption*. Most SMEs operate with a limited capital and have little money to invest in new technologies like cloud computing. They think *initial start-up cost of adopting cloud services is a burden and a factor for the late adoption.* 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 *continue changing ISPs with the hope of getting one that will provide a reliable and uninterrupted Internet connection.* • Due to its online nature, cloud computing requires a constant power supply. The frequent power outages experienced in Ghana is another factor that negatively influenced the adoption decisions. *They feel that although generators can be installed to keep the power, not all SMEs can afford to run solely on generators. This is a major barrier to the adoption of cloud computing.* 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. Additionally, 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.*

A conclusion can therefore be drawn from the results in Table 6.28 and a framework formulated to assist SMEs to adopt cloud computing successfully in their operation. Thi framework is described and refined in the chapter that follows.

The next chapter provides a detailed discussion of the proposed framework for cloud computing use within SMEs which is the primary objective of the study. The proposed framework was based on the literature reviewed and the questionnaire and interview findings that were discussed in this chapter. The remaining data collected, in the form of expert reviews used to refine the framework, is also provided in the next chapter.


Problem Identification and Motivation
Chapter 1
Research Problem and Its Setting
Theoretical Background
Chapter 2
SME Competitiveness and Technology Usage
Chapter 3
Cloud Computing Adoption within SMEs
Chapter 4
Technology Acceptance Models
Chapter 5
Research Design and Methodology
Empirical Findings
Chapter 6
Research Findings, Interpretation and Discussion
Defining the Objectives for a Solution
Design and Development
Demonstration and Evaluation
Chapter 7
Framework for Cloud Computing Adoption in SMEs
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Chapter 7:
7.1 Introduction
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7.7 Guidelines to Perform a Cloud Computing Adoption Assessment
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Chapter 7: Framework for Cloud Computing Adoption in SMEs

7.1 Introduction

The main objective of this research project is to suggest a framework for cloud computing adoption by small and medium-sized enterprises. Using the design science research approach, literature reviewed and the empirical findings discussed in the previous chapter, the formulation of the proposed cloud adoption framework is described in this chapter. The framework is the expected artefact required in a design science research. Expert reviews were used to refine the framework as per the requirement of the design science research methodology. An extract of the design science research process as applicable in this chapter is shown in figure 7.1 below.

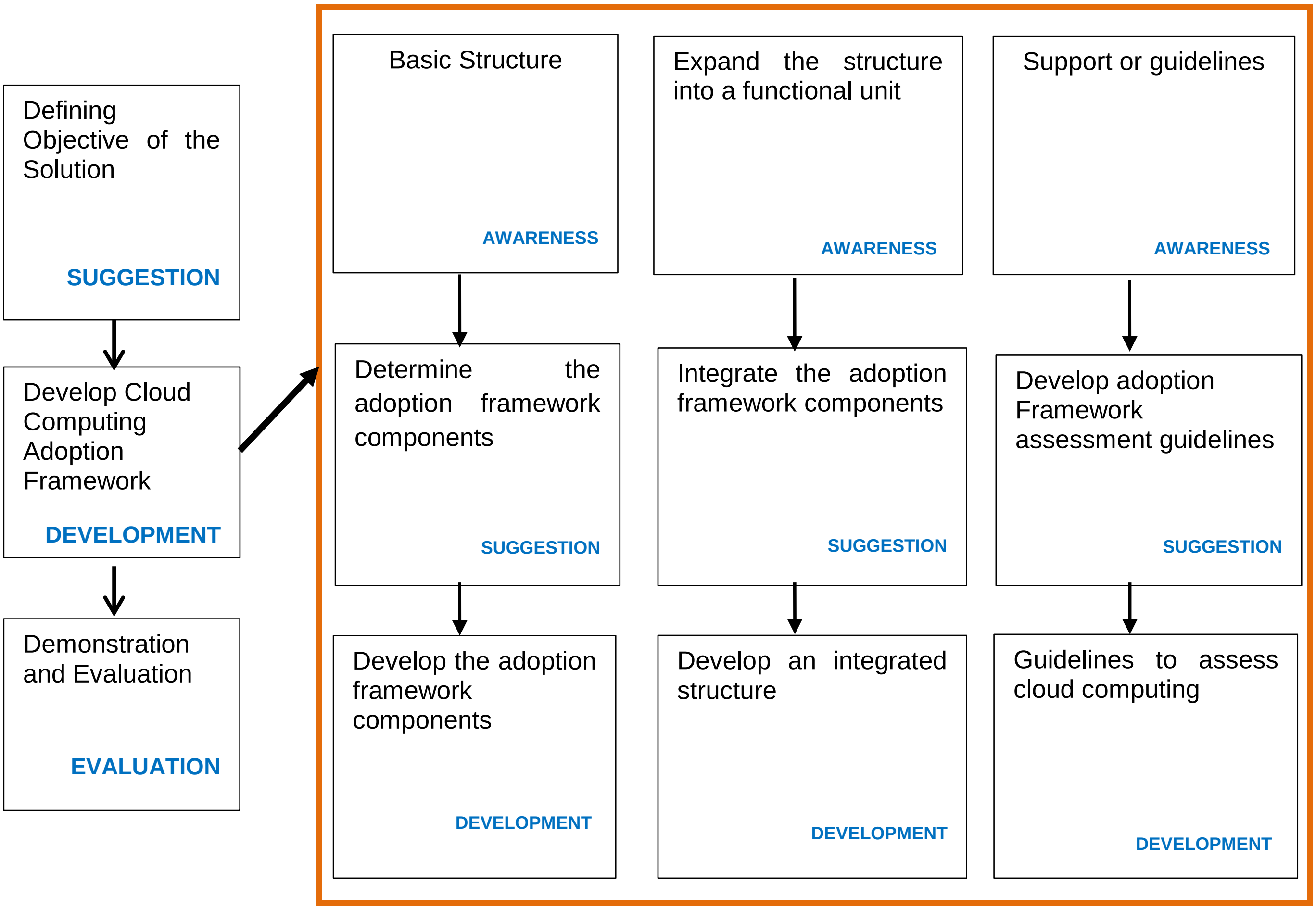


Figure 37.1: Extract of design science research process with applicability to chapter 7 (Own Creation)

The figure indicates the elements in the design science research process that will be focused on in this chapter. This chapter begins with the introduction and explanation of the initial cloud computing adoption model. The model was the initial artefact based on literature reviews and empirical findings. The expert review and necessary refinement to the model are then detailed. The final framework artefact and guidelines for assessing the cloud computing environment are then described. The framework is evaluated before the chapter is summarised in the conclusion.

7.2 The Initial Cloud Computing Adoption Model

An extensive literature review was conducted for the creation of the questionnaire and interview guide used to gather empirical data on cloud computing adoption by SMEs. The analysis of the findings revealed that a number of factors influence the adoption of cloud computing within SMEs. The model represented an assessment of the research findings that were explored and integrated to offer a model for the adoption of cloud computing by SMEs. The model is presented in figure 7.2 below.

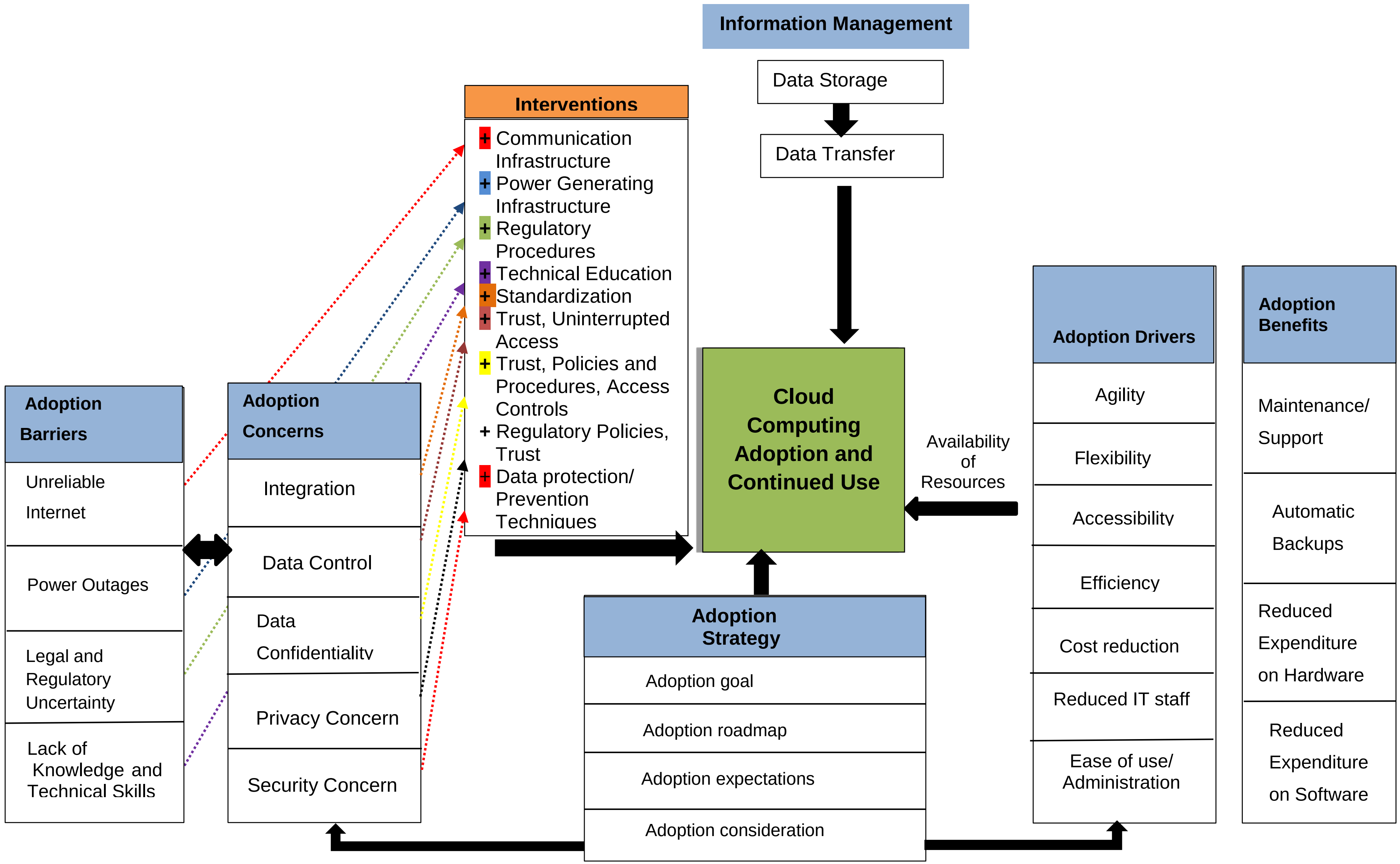


Figure 7.2: Initial Cloud Computing Adoption Model (Source: Own Creation)

7.3 Components of the Initial Cloud Computing Adoption Model

The model identifies the storage and transfer of information on a cloud platform as critical to SMEs. SMEs are more willing to adopt cloud services if their information can be transferred with less difficulty and in a secured environment. Service providers need to assure SMEs of this service if they are to use cloud services. The model also identified the fact that if SMEs are aware of the benefits they stand to gain from using cloud services, they are motivated to adopt the technology once they have the required resources. Once they decide to adopt cloud computing, they follow a strict adoption strategy to ensure a successful adoption process. Cloud computing is a new technology and therefore its adoption is often surrounded by concerns and barriers. These concerns and barriers need to be addressed if SMEs are to adopt and continue to use cloud services to make them competitive.

7.3.1 Information Management Practices on Cloud Platform

Cloud computing presents a number of characteristics that require special attention especially on the part of the service provider to improve trust in the system. According to Sun, Zhang, Xiong and Zhu (2014) resource security, resource management and resource monitoring require special attention on the part of service providers. The model which was informed by the findings of the empirical study identifies two key attributes of information management in the cloud. These are data storage and data transfer strategies. These are discussed in detail in the sub-sections which follow.

7.3.1.1 Data Storage

The cloud computing environment affords the opportunity for users who do not necessarily have the time, feasibility or resources to monitor their data to compute and store data. They delegate the responsibility of storing their data to a service provider. Users trust the service provider to have the expertise and capabilities to store more data with considerably less complexity. This means that service providers must put measures in place to ensure that files stored in the cloud are highly available and accessible to users at any time from any place through Internet access. Thus, in order to access or share files, users must not be limited in anyway by bandwidth, as a slow or unstable Internet connection might result in problems accessing data in the cloud. According to Byrne (2012), storage must operate without disruption in the event of outages or planned maintenance activities.

Empirical findings from the previous chapter show that:

1. 80.46% of respondents indicated that cloud computing allows for the storage of more data than on normal computers platforms. This gives users off-site backups of data which help reduces the costs associated with disaster recovery.

2. Respondents are hopeful that service providers would store their critical data securely and put measures in place to protect the data.

3. Most respondents indicated that their data is sensitive and some have proprietary attachments. They therefore carefully profile service providers to ensure they are up to the task of storing their data in a secure manner.

It can therefore be concluded that respondents are aware and appreciate the storage capacity of cloud computing and are prepared to invest in all the key areas necessary to ensure constant accessibility to their data.

7.3.1.2 Data Transfer

Cloud computing is an Internet-based service that allows for the transfer and storage of large amounts of data because it is elastic. Resources can be assigned to handle increased demand. The transfer of data from service providers to users occurs via broadband communication infrastructures. However, these infrastructures are better suited for communication than for distribution, thereby leading to data transfer bottlenecks (Benati, 2013). The demand for fixed infrastructure and high-speed is thus expected to increase resulting in a possible challenge of data transfer bottlenecks from and to cloud computing service providers.

The findings drawn from the empirical study show that:

1. 42.53% of respondents believe that the movement of large amounts of data in the cloud occurs with difficulty.

2. Respondents hope to invest in network bandwidth to ensure accessibility of their data and to keep the volume of traffic flowing.

This indicates that respondents are very particular about how the movement of data across platforms occurs.

7.3.2 Adoption Drivers and Benefits

As discussed in chapter 3, cloud computing offers a number of benefits. A benefit is the value realized after the usage of cloud services to meet the business needs of the firm, while optimizing costs. Businesses experience cloud computing benefits if the benefits are well understood, there is clear accountability for assessing the benefits, relevance metrics, and effective benefits realization process after investing in the technology (ISACA, 2011). Benefits are key adoption drivers (Porta, Karimi, Plaskon, & Sharma, 2009).

The findings from the empirical data show that key adoption drivers include accessibility, flexibility and agility, reduced cost and increased efficiency, reduced IT staff and system administration. Benefits that drive SMEs to adopt cloud computing are maintenance and support, backups, and scoring economic benefits on hardware and software. These are discussed in detail in the next subsection.

7.3.2.1 Accessibility

Cloud computing resources should be made accessible to users wherever and whenever they wish without any form of hindrance from the service provider. According to Holbl (2011) the service is accessed remotely through the Internet and this might create a problem in situations where the connection between the user and the service provider is not reliable and not well protected. Accessibility of cloud services is affected by downtime, denial of service attacks and network downtime (Holbl, 2011). Kumar *et al.* (2011) further stated that cloud computing services are largely dependent on the reliability of secure telecommunications networks. Therefore there is a need for cloud computing service providers to assure and guarantee their users undisrupted services and provide alternative means of data access to users in the case of network or telecommunications failures. Accessibility of cloud services is related to the availability factor of the Confidentiality Integrity and Availability (CIA) triad. This factor also relates to the ability of users to access data via a cloud computing platform.

The empirical findings in the previous chapter show that:

1. 75.48% of respondents indicated that they can access their data in the cloud anywhere and at any time. They express this as an important driver to cloud computing.

2. 42.53% were of the view that the movement of large amounts of data from a cloud platform might occur with difficulty.

3. Respondents indicated cloud computing services are highly accessible and this put them at an advantageous position. They also expect service providers to remain consistent to enhance their trust in cloud computing.

This means accessibility of user data with ease drives businesses to adopt cloud computing services.

7.3.2.2 Flexibility and Agility

The common definition of cloud computing is the distribution of scalable IT resources as a service over the Internet as opposed to hosting and operating those resources in-house. Thus, concerns related to cloud computing may be associated with hardware performance, software configurations and geographical locations (Shawish & Salama, 2014). This gives businesses the flexibility to manage cost through outsourcing. According to OECD (2014), the variety of cloud services spans a wide spectrum; with services providing increased degree of flexibility and customization, and other services providing a high level of convenience. Businesses are attracted to deploy cloud computing architectures that provide vastly greater flexibility (Kushida, Murray & Zysman, 2014). Service providers must therefore reduce limits on the kinds of application that can be hosted on these services by making their delivery models flexible.

Cloud computing also promotes business agility. According to Bittman (2011) agility and speed are key drivers for moving to the cloud. Unlike a traditional model of computing that requires time for the design, implementation and testing of infrastructure, cloud computing allows the use of infrastructural services on an immediate basis. Thus, one can experience a higher time to value ratio with cloud computing, leading to higher revenue and higher market reach.

The empirical findings from the previous chapter show that:

1. 70.50% of respondents indicated that they are attracted to cloud computing because of the greater flexibility the service offers.

2. 62.84% of respondents agreed that using cloud computing services will lead to a faster time to market through increased efficiency.

3. 78.93% of respondents also indicated cloud computing creates an innovative business climate which enhances their ability to reach other markets.

4. Several respondents indicated that the flexible nature of cloud computing allows them to integrate their hosted business applications with the cloud platform. This is an important parameter for business.

5. Respondents also indicated that the outsourcing nature of cloud computing frees them from building and maintaining IT infrastructure. This helps them to focus on core business processes.

It is therefore important for service providers to establish cloud platforms that are flexible enough to adapt to the various technology needs of a potentially large number of users.

7.3.2.3 Reduced Cost and Increased Efficiency

According to LuitBiz (2010) synonymous with traditional cloud computing is the provision of on- demand computing resources via the Internet owned and operated by an off-site service provider. This reduces the cost of infrastructure and their management to operational costs rather than a capital cost. The payment for IT resources are therefore on a per-use basis using an OPEX charging style, where the user pays for consumption of the service on the basis of the resource units consumed.

If users adopt cloud computing they escape spending large sums of money on buying and installing new IT infrastructure, applications and software. Additionally, according to LuitBiz (2010) users avoid paying for excess resource capacity to meet fluctuating demand. Moreover, cloud computing reduces upfront capital on hardware and software deployment. Keane (2011) also added that cloud computing service providers offer infrastructure support and help desk services to customers who face problems using the various cloud computing services. Thus, users save money on support as they will use the service provider's support structures.

According to Laugesen, Lauritzen, Ellegaard, Bucher and Stabe (2012) the outsourcing of IT resources has not always been relevant as the economies of scale have not been enough and the related costs of information and communication technology (ICT) have been a barrier for small businesses. They further added that these related costs can be a barrier to cloud sourcing, but the economies of scale are not an issue as cloud computing provides small businesses with the opportunity to increase their competitiveness without large capital expenses (Laugesen et al., 2012). Also cloud providers can offer infinite amount of resources to many users at any time. Because of reduced cost and time, firms can focus efforts elsewhere and be more efficient.

The empirical findings from the study show that:

1. 80.08% of respondents agreed that cloud computing helps to transform capital-intensive set up to a variable priced environment.

2. 73.56% of respondents indicated cloud computing will make them efficient in their operation because of the always-on nature of access to data.

3. Most respondents were of the view that it's more expensive to purchase hardware and software and train personnel to maintain them, than it is to source from the cloud.

4. The majority of respondents indicated that adopting cloud computing means they do not have to waste money on technical support. This will be taken care of by the service provider.

5. Respondents indicated that the initial cost component of adopting cloud computing is a significant barrier.

This means that the reduced expenditure on IT resources motivates businesses to adopt cloud computing.

7.3.2.4 Reduced IT Staff and System Administration

In the traditional model of computing, firms purchased and ran all their own hardware and software systems. They required capital investment in in-house staff, and also regular training programmes to ensure the successful running of an enterprise's IT infrastructure. According to Jennings (2015) the staffing budget is usually the biggest single line item and often makes up more than half of the total computing costs of firms. With a shift to cloud computing, firms no longer need to employ experts in every area of technology and take on responsibility for training them up. The cloud provider runs and manages all the services offsite. According to West (2011) the use of software from the cloud leads to a reduction in systems maintenance and updating of the software. These functions are done by the cloud service provider. This will also allow small firms to have access to the kind of expertise and products previously restricted to larger firms. Thus, there will be fewer in-house IT staff and less system administration when using cloud computing.

The empirical findings in the previous chapter show that:

1. 83.91% of respondents agreed that adopting cloud computing means a reduction in the number of employees in the IT department.

2. 74.72% of respondents indicated that since cloud computing is a service rendered by an offsite provider, there is little or no system administration to be done.

3. Respondents indicated that cloud computing allows them to easily integrate their hosted business applications with the cloud platform and added that this frees them from building and maintaining IT infrastructure. This means a reduced workforce in the IT department.

7.3.2.5 Adoption Benefits

Firms often adopt the different cloud computing deployment and delivery models to score economic benefits on hardware, software, maintenance and backups. These economic benefits have a positive influence on cloud computing adoption (Tan and Lin, 2012, Borgman et al., 2013).

The empirical findings in the previous chapter show that:

1. SMEs indicated that they cloud-based solutions brings savings by reduces their expenditure on hardware and backups.
2. SMEs also stated cloud computing gives operational efficiency by making ensuring a high up-time.
3. SMEs claim they get technical support on internally installed software from service providers

The reduced staff and system administration means businesses save money and human resource and this motivates them to adopt cloud computing. The next section discusses some of the concern and barriers business face in their attempt to adopt cloud computing.

7.3.3 Adoption Concerns and Barriers

Despite the numerous benefits, concerns associated with cloud computing service still remain. For users who place emphasis on control, security, and privacy, cloud computing may not provide a suitable computing environment. The study identified integration, data control, data confidentiality, security concern, privacy concern, unreliable Internet connection, legal and regulatory uncertainty, power outages, and lack of knowledge and technical skills. Additionally, factors such as connectivity, power outages, legal and regulatory uncertainty and the lack of knowledge of cloud computing were significant responses that emerged as barriers to the adoption of cloud computing.

The following sections discuss these factors in detail.

7.3.3.1 Integration

In a typical IT outsourcing environment the service provider takes responsibility for the legacy systems and migrates customers to a new solution. In cloud computing however, the customer assumes the responsibility for integrating the legacy technology and the cloud solutions. According to Opara-Martins, Sahandi and Tian (2014), the decision to adopt cloud computing will be severely affected if there is no effective means of integrating data and applications across cloud platforms. The cost and complexity of developing and maintaining integrations on distinct platforms with different interfaces and protocols has the potential of shadowing the economic and efficiency gains the cloud offers. It is expected that the standardization of cloud application programming interfaces (APIs) will help tackle this challenge. As a result Kavis, (2014) stressed the need for standard bodies, vendors and users alike to work together to establish standards and APIs in different locations.

The empirical findings from the study show that:

1. 75.48% of respondents indicated that they are deterred from adopting cloud computing because of the issues associated with the integration of their in-house applications with the cloud platform.

2. 64.75% of respondents fear their existing applications may not be compatible with the cloud solution after adoption.

3. Respondents indicated that they rely on the service provider to make available tools and resources to help synchronize their in-house applications with the cloud platform.

There is therefore the need for industry standards and best practices to reduce the problems associated with data integration with the cloud.

7.3.3.2 Data Control

From the literature reviewed in chapter 3, it is evident that cloud computing users are concerned about a lack of control over their data. The service provider retains all the technical control and leaves an inherent risk of the data being exposed to third parties (Kumar et al., 2011). Users however strive to achieve requirements for physical access control over their data.

According to Holbl (2011) users are often aware of the risks related to handing over control of their data and storing sensitive information on a third party's platform. Data control concerns are related to the availability factor of the CIA triad. When users have uninterrupted access to their data, there is often the perception by the user of having control over their data. If users perceive that they are in control, they are more likely to trust in cloud computing services and hence adopt and use the service.

The findings in the previous chapter indicate that users are conscious of data control issues and how relevant this is to the decision to adopt and use cloud computing services. The empirical findings show that:

1. 75.48% of respondents agree that data control is a relevant concern when it comes to the adoption and use of cloud computing.

2. 75.81% of respondents expect service providers to provide their data control techniques to help them achieve physical access control over their data.

3. 83.63% of respondents indicated that they expect the service provider to maintain user authentication and access controls since the cloud and all of its data are accessible to anyone on the Internet.

4. Respondents indicated that the uncertainties of data ownership and control inhibits them from placing their sensitive information in the care of a third party.

It is therefore important for users to have control of their data as this will enhance transparency and visibility in the cloud.

7.3.3.3 Data Confidentiality

Data confidentiality is a major issue in cloud computing as it has legal implications and implications on user trust (Kumar *et al.,* 2011). There is often mistrust on the part of cloud computing users especially when it comes to the transfer of high volumes of confidential and sensitive information in the cloud. This makes them reluctant to use cloud computing services for storing sensitive data. From the CIA triad, confidentiality is the act of not disclosing a user's information and data to unauthorized parties. Measures should therefore be put in place by the service provider to ensure that user's data is kept confidential to enhance trust between the service provider and the user. Failure to ensure data confidentiality has a negative effect on user trust in the service and according to Wooley (2011), this may damage the service provider's reputation and have legal implications.

The empirical findings from the questionnaire and interview indicate that:

1. 75.83% of respondents indicated that they expect service providers to put control and validation controls in place to ensure their data is kept confidential.

2. Respondents indicated that they insist on regulatory implications of moving data from one point to another and make sure the service providers satisfy those regulations. They then request for evidence of compliance from the service provider.

3. Respondents indicated that they usually sign SLAs in which they work out penalties should service providers fail to keep their data confidential.

There is therefore the need for service providers to offer assurances of data confidentiality in order to build trust among users.

7.3.3.4 Security Concern

The scattered nature of data in different machines and storage devices in a cloud computing environment makes data security a serious issue. Data security in cloud computing is more complicated compared to data security in traditional information systems (IS). According to Sun et al (2014), the trust of the entire cloud system depends on the data protection and prevention techniques used in it. This therefore underscores the need for service providers to implement operational security measures to ensure data in the cloud is protected and prevented from unauthorised access to mitigate the hurdle of trust.

In order to prevent gaps in the implemented security measures in the cloud, they must be effective, efficient and operationally functional at all times. Sood (2012) called for the implementation of security measures through ensuring the presence of the three cryptographic parameters as described in the CIA triad. Service providers must therefore enforce security measures to improve the user's perceptions of their ability to maintain the confidentiality, integrity and availability of the data stored on a cloud platform.

The findings from the previous chapter show the importance users attach to the security of their data on the cloud:

1. 86.20% of respondents are conscious of the issues associated with the security of data in a cloud computing environment especially the integrity and confidentiality of data.

2. 83.93% of respondents indicated that they expect cloud service providers to present them with an outline of their data security measures. Thus, there is a need for these measures to remain operational to ensure user trust and continued use of cloud services.

3. Respondents indicated that they usually profile service providers to ensure they are up to the task of providing the needed capacity in a secure and competitive manner. Cloud computing service providers must therefore win the trust of users by ensuring user's data are handled in a secured environment.

4. Most respondents expect service providers to put measures in place to protect their data because of the sensitive nature of the data. This is to make the cloud computing environment trustworthy.

5. Some respondents had experienced some security breaches and therefore require adequate security measures to assure users of a trustworthy environment and to win the confidence of users to adopt cloud computing.

The empirical findings suggest the security of user's data influences the decision to adopt and use cloud computing services. It is imperative that the user verify the existence and adequacy data security measures put in place by service providers.

7.3.3.5 Privacy Concern

From the literature reviewed in chapter 3, it is evident that cloud computing users have issues with privacy in the cloud. According to Dahiru, Bass and Allison (2014) while security in the cloud relates to the vulnerability of data and the fear of attacks by external parties, privacy has to do with a breach of trust by the cloud service provider. Kumar *et al.* (2011) stated that the location of cloud computing service provider makes it extremely difficult for users to keep track of data entrusted to them at all times. Firms dealing with highly confidential and sensitive information are therefore skeptical about putting their information in the cloud and are reluctant to adopt and use cloud services. This is because putting this type of information in the cloud has the risk of unrestrained access of that information by competitors using the same cloud platform.

User's data needs to be secured and protected from other users of the service provider, as this can jeopardize a user's competitive advantage. There must also be guarantees from the service provider that user's data will not be used for any unintended purposes. In instances where the service provider is in another country, there is the risk of data confiscation by authorities in the service provider's country when the regulations of that country are violated. Hence, the user needs to trust the service provider to ensure a good working relationship.

The findings in the previous chapter show that respondents are conscious of the privacy issues in the cloud. The empirical findings show that:

1. 80.95% of respondents agreed that privacy is an issue in the cloud and this affects their decision to adopt and use cloud services.

2. 47.83% of respondents indicated that they have experienced some sort of Internet security breach.

3. Respondents stated that they are careful about the type of information to be kept in the cloud. They would rather host very sensitive information in-house than on a cloud platform because of privacy concerns.

There is therefore the need for service providers to establish a lasting trust with customers and abide by existing data protection laws.

7.3.3.6 Unreliable Internet Connection

The availability of a reliable Internet connection and sufficient bandwidth is a major barrier to the uptake of cloud computing (Kshetri, 2011). Accessing cloud services anytime and anywhere requires a robust telecommunications infrastructure and network connection. However, broadband connectivity remains a problem especially in developing economies which have a slow and unstable connection. While other countries meet the minimum requirements for advanced cloud services, Ghana falls in the category of countries which meet the minimum requirements for basic cloud services (UNCTAD, 2013). According to Tweneboah-Koduah, Endicott-Popovsky and Tsetse (2014), nearly 85% of Ghanaian population do not have access to reliable and stable Internet both at home and their workplace. Since universal connectivity is a major requirement for the successful adoption and usage of any cloud service, it remains a barrier for businesses in Ghana.

This is evident in the responses obtained from the empirical study. The results show that:

1. Respondents see the unavailability of a reliable and stable Internet connection as a major factor that negatively affects their decision to adopt cloud computing services.

2. Respondents indicated that there is a fear of not being able to access their data because of a poor Internet connection.

3. Respondents added that they hope to increase their bandwidth prior to adoption for easy access of their data.

Therefore technical infrastructure regarding broadband connectivity negatively impacts the adoption of cloud services. This means that the development of efficient communication infrastructure is critical for competitive production and distribution to ensure reliable and sufficient bandwidth.

7.3.3.7 Legal and Regulatory Uncertainty

As discussed in chapter 3, cloud computing is still a new innovation and therefore the level of uncertainty is relatively high and this slows its adoption by small businesses. One of such barriers is the uncertainty that relates to the legal and regulatory aspect of cloud computing (Pigal, 2012). This is particularly the case in a public cloud environment where users have little influence on the technical layout that underpins the cloud service. The trans-border nature of cloud computing creates uncertainties about applicable laws, similar to that for other Internet services (ITU, 2012). It is difficult for users to predict the exact location of their data and this could potentially lead to trans-boundary legal issues. The physical location of data should be a matter of concern as there are no existing internationally agreed rules on data privacy and protection.

This is reflective of the responses obtained from the empirical study. The findings from the empirical work show that:

1. Respondents indicated that cloud computing is a paradigm shift from how they work and they are therefore skeptical about the future of the technology.

2. Respondents mentioned that most of the service providers are outside the country and they do not know the laws that govern the transfer of data from those countries.

3. Respondents also indicated that the service providers have other offices in other countries and this makes it difficult for them to know the exact location of their data.

The empirical findings suggest that cloud computing services impact a range of regulatory aspects, both within and across jurisdictions. It is therefore imperative that regulators establish information regulatory procedures and coordinate regulatory decision-making that is targeted at cloud service providers and end users of cloud services.

7.3.3.8 Power Outages

Though cloud computing is an affordable alternative for businesses to cut costs involving electricity (Almunawar, Kang & Susanto, 2012), the online nature of cloud solutions makes it dependent on a constant power supply. However, the infrastructure for the generation of reliable power generation and broadband is lacking in developing economies (ITU, 2012). Basic infrastructure is therefore a major factor affecting the adoption of cloud computing. Power outages mean users will not enjoy the reliability and constant availability of cloud services. This can be unexpected and costly to a customer (Tweneboah-Koduah *et al*. 2014). Enterprise data is critical and needs to be available on-demand. In the event of power outages, contingency plans must take immediate effect smoothly to ensure its continual availability.

The results of the empirical study support this assertion that power outages are a barrier to the adoption of cloud computing services. The findings show that:

1. Respondents indicated the erratic power outages experienced in the country are a major barrier to the adoption of cloud computing.

2. Some respondents said they have to spend large sums of money to purchase and maintain standby generators to keep the power on in order to enjoy the constant availability of cloud services.

3. Other respondents also stated that although generators can help keep the power on, they cannot afford to run solely on generators for long. This means they would not enjoy the satisfaction of using cloud services.

4. Some respondents compared the severity of this barrier to that of an unreliable Internet connection and concluded that power outages are a more severe barrier.

Therefore technical infrastructure regarding the generation of a reliable power supply negatively impacts adoption. For businesses to enjoy the constant availability that cloud computing provides, basic infrastructure is needed for the generation of a reliable and constant power supply.

7.3.3.9 Lack of knowledge and technical skills

Cloud computing is still a new innovation and therefore the level of knowledge and technical skills to operate cloud services is relatively low. According to Rahab and Hartono (2012) SMEs typically lack specialized IS knowledge and technical skills. The obstacle of acquiring the appropriate skills and technical knowledge in the deployment of cloud computing services, often leads to the point where firms suspend the adoption until they have the necessary expertise. Therefore, firms with employees who are more knowledgeable about cloud computing and aware of the strategic adoption importance are more likely to adopt.

The findings from the empirical study show that:

1. Most of the respondents expressed the fact that they lack the technical skills needed to run a cloud system.
2. Respondents indicated that there is a skills gap fear for cloud computing and they would recruit personnel based on their specific cloud skills to handle specific risks.
3. Respondents stated that employees require some form of training to take advantage of cloud computing. This would impact on the cost associated with cloud computing.

There is therefore a need for businesses to develop the necessary skills and knowledge to deliver the benefits it expects from the cloud.

7.4 Expert Review of the Initial Cloud Computing Adoption Model

In order to develop the cloud computing adoption framework (artefact), an initial model was proposed from the findings of the empirical study. The components of the model served as the elements of the framework. This model was presented and described in Section 7.3.

Experts were tasked to evaluate the model. The experts acknowledged the relevance of the model in providing some of the adoption factors worth considering ensuring a successful adoption process (a solution for a recognised problem). The experts recommended the explanation of each component of the model and their effect on adoption. This, they acknowledge, will bring clarity in the final adoption framework that will solve the problem of adoption.

Overall, the proposed model was deemed to contain appropriate elements for the development of the adoption framework. These elements were the results of the empirical study. The next section describes the elements of the different components of the model.

7.5 Framework for Cloud Computing Adoption in SMEs

The initial cloud computing adoption model identified four main factors as influencing the adoption and use of cloud computing services. These factors are adoption benefits and drivers, adoption concerns and barriers, adoption interventions and information management practices. These factors were refined and expanded into a framework to help SMEs adopt and use cloud computing services successfully.

The study has a primary objective to develop a framework for cloud computing adoption by SME in the Accra-Tema metropolis of Ghana. From the design science research process discussed in Figure 5.5, this is achieved through the following sub-objective:

1. Investigate cloud computing to improve information practices for SMEs.
2. Investigate factors necessary for a framework in support of cloud computing use in SMEs.
3. Investigate the stumbling blocks for SME in using cloud computing.

The previous section identified factors that influence the decision to adopt and use cloud computing among SMEs. This section defines the objectives and provides recommendations for the development of the proposed cloud computing adoption framework.

The definition of objectives for a solution represents the objectives of the solution phase of the design science research process discussed in section 5.5. From the literature reviewed on cloud computing adoption, the study recommends four steps for defining objectives for a solution to the successful adoption of cloud computing, namely:

1. Structure of the adoption framework
2. Identification of the adoption components
3. Integration of the adoption components into a functional unit
4. Method to apply the cloud computing adoption framework.

These objectives are discussed in the sections that follow.

7.5.1 Structure of the Adoption Framework

The reviewed literature in chapter 3 and the research findings in chapter 6, suggest the need for the development of adoption structures and guidelines for cloud computing. The main objective of the study is to propose a framework for cloud computing adoption to enhance SME competiveness. This can be achieved through the three sub-objectives. Thus, to ensure successful adoption, there is a need for a better understanding of the adoption factors. It can therefore be concluded that the key elements of the proposed adoption framework are the four main adoption factors identified in the study. They are adoption drivers and benefits, adoption concerns and barriers, adoption interventions, and information management practices (shown in Figure 7.3).

According to ISACA (2006), a framework offers different levels of guidance, including standards (i.e. mandatory requirements), guidelines (i.e. guidance in implementing the standards) and procedures (i.e. steps to follow in meeting the standards). For the development of the proposed cloud computing adoption framework and taking into consideration the adoption factors, some suggestions were made from the first round of expert review for the framework and these presented in figure 7.3 as follows:

1. *Basic structure:* Determine the adoption framework component, while considering the core factors influencing the adoption, i.e. adoption drivers and benefits, adoption concerns and barriers, adoption interventions, and information management practices.

2. *Expand the structure into a functional unit:* Integrate the identified components to formulate a functional structure.

3. *Guidelines:* Devise a means to implement the cloud computing adoption framework (i.e. guidelines to assess a cloud computing environment).

Relating this to the design science research process discussed in section 5.5, figure 7.4 shows the use of three sub-suggestions in perspective of the primary suggestion, to define the objectives for the development of cloud computing adoption framework for competiveness.

Cloud Computing Adoption

Initial suggestions for the development of the cloud computing adoption framework	**Adoption Benefits/Drivers**	**Adoption Challenges/Barriers**	**Adoption Interventions**	**Information Management Practices**
Determine the components	• Understanding the benefits that drives users to adopt • How to identify and evaluate the benefits of cloud computing (i.e. benefit identification and evaluation guideline).	• Understanding the concerns and barriers of cloud computing • How to identify and evaluate the concerns/barriers of adoption (i.e. concern identification and evaluation guideline)	• Understanding of the existing or likely intervention for a successful adoption • How to identify and evaluate intervention (i.e. intervention identification and evaluation guideline)	• Understanding the management of information on a cloud platform • How to identify and evaluate the information management practices (i.e. information management activity identification and evaluation guideline)
Integrate the identified components to into a functional structure	• Integrate the identified components into a functional structure • Determine the relationship between the identified components.			
Formulate a method to apply the cloud computing adoption framework (i.e. guidelines to carry out an assessment of a cloud computing environment).	• Illustrate and describe how to use the Framework.			

Figure 7.3: Suggested adoption framework for cloud computing (Source: Own Creation)

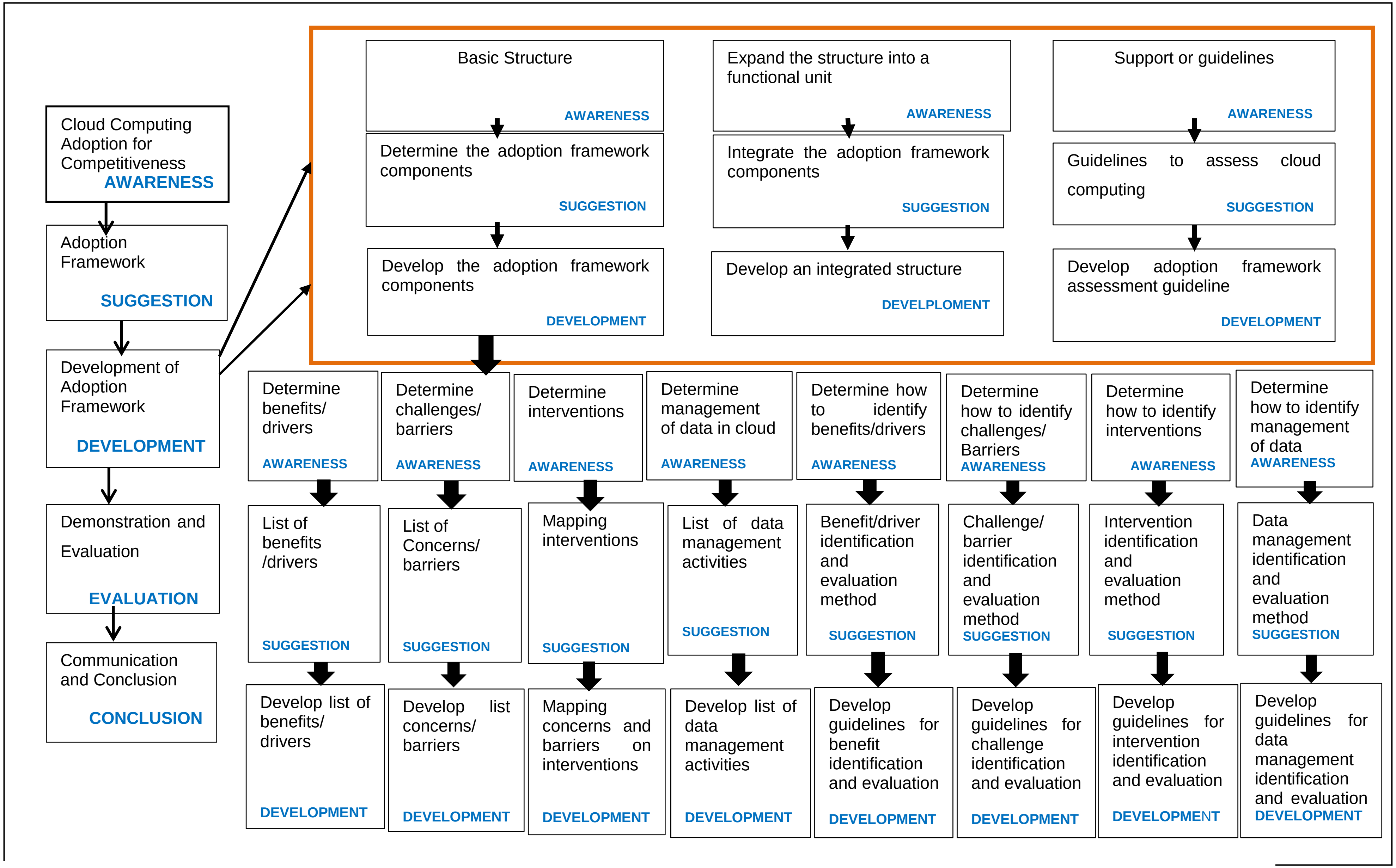


Figure Figure 7.4: Suggestion phase of design science research process applicable in current study (Source: Own Creation)

7.5.2 Identification of the Adoption Components

The empirical findings show that the key cloud computing adoption factors, which are also the components of the adoption framework are adoption benefits and drivers, adoption concerns and barriers, adoption interventions, and information management practices. These are discussed in section 7.3 and presented in figure 7.2. Understanding how these components affect specific cloud computing environments requires the need to identify and evaluate these components. The proposed cloud computing adoption framework should therefore also have guidelines to identify and evaluate cloud computing adoption benefits and drivers, adoption concerns and barriers, adoption interventions, and the management of information.

Thus, the development of the suggested cloud computing adoption framework requires:

1. A list of cloud computing adoption benefits and drivers from empirical findings.
2. A list of cloud computing adoption concerns and barriers from empirical findings.
3. A list of corresponding adoption interventions.
4. The information management issues identified in the empirical findings.
5. Mapping of adoption concerns and barriers to interventions
6. Benefit and adoption driver identification and evaluation guidelines
7. Concern and barrier identification and evaluation guidelines
8. Intervention identification and evaluation guidelines
9. Information management practice identification and evaluation guidelines.

The development of the lists of benefits and drivers, concerns and barriers, interventions, and information management activities are discussed in section 7.3. However, the development of the identification and evaluation guidelines of cloud computing adoption benefits and drivers, concerns and barriers, adoption interventions, and information management activities are discussed in the sub-sections which follow.

7.5.2.1 Adoption Benefits and Drivers Identification and Evaluation Guidelines

The development of the identification and evaluation guidelines of the benefits and drivers, concerns and barriers, interventions, and the management of data on cloud platforms each has a number of objectives. In the current study, an objective describes what needs to be investigated or achieved. There are sub-objectives and they represent a lower-level idea of the same kind.

The adoption benefit and driver identification and evaluation guideline seeks to help firms to decide whether cloud computing is a better solution to optimize the infrastructure. Porta *et al.* (2009) recommend a cost benefit analysis to ensure firms prioritize cloud computing adoption areas. It is therefore important for firms to identify and evaluate the benefits they stand to gain from the cloud service. The identification and evaluation guideline as shown in figure 7.3 can be broken down into two objectives:

1. *Identify cloud computing benefits and adoption drivers:* The process of identification includes finding, listing and characterizing the benefits of cloud computing. The benefits and drivers of cloud computing from the empirical study are presented in figure 7.2 and discussed in section 7.3 of this chapter and can be used as the baseline.

2. *Evaluate the identified benefits and adoption drivers:* The evaluation of the benefits and drivers of cloud computing adoption must cover six areas (Deloitte, 2010; ISACA, 2011):

   a. *Strategy:* There is a need for the development of a clear adoption and migration strategy in line with the business needs, goals and IT capabilities of the firm. This objective is to ensure the firm’s business needs are achieved, goals are met, and that there is a successful adoption process.

   b. *Criticality and importance:* This objective involves critically understanding the importance and associated concerns related to the data to propose appropriate cloud-based solutions.

   c. *Architecture and technology:* Identify the capabilities and value of the cloud architecture, technology requirements and migration strategies for the selected asset(s). This includes identification of the most appropriate cloud deployment models, cloud service models and cloud service providers. The issue of acceptable levels of risk and the required level of control over assets in a particular cloud environment must be taken into consideration. Evaluate benefits and adoption drivers based on the firm’s technology requirements.

   d. *Governance and compliance:* Determine how the benefits align with the firm’s existing IT governance framework and cloud adoption strategies, policies and frameworks. Evaluate benefits based on requirements and compliance with appropriate laws and regulations.

e. *People and changes:* Understand and create roles and ensure enough skill and knowledge for the successful adoption of cloud computing. Consider and implement effective change management strategies. Engage key stakeholders and evaluate change readiness.

f. *Business case:* There must be proper documentation of all benefits and drivers and their value to the firm and IT environment. Understand and document the movement of data between the firm, the cloud service provider and other customers to ensure that risks are identified and understood. Build a detailed business case for acceptance and approval for the deployment of the cloud solution.

Based on the two benefit identification objectives, six areas of consideration and the outcome of the empirical study, the guideline for the identification and evaluation of cloud computing adoption benefits and drivers is presented in table 7.1.

Table 7.1: Adoption benefit/driver identification and evaluation guideline (Source: Own Creation)

Objective	Sub-objective
Identify cloud computing benefits and drivers	1. List and characterize the identified benefits and drivers. For this study, SMEs surveyed mentioned some specific cloud computing benefits and adoption drivers. These are discussed in section 7.3 and it forms the baseline.
Evaluate the identified benefits and adoption drivers	***Strategy***
	1. Determine how business needs and goals could be achieved through the adoption of cloud computing. Questions and issues worth noting include: • Which business goals or needs could be met through the adoption of cloud computing? • Which cloud strategy best aligns with the business needs and goals?
	2. Outline cloud computing opportunities, define its value and quantify the benefits of adopting cloud computing. Questions that may arise include: • Is cloud computing the solution to your IT needs? • What cost or benefits are likely to be realized by adopting cloud services? • How valuable is a cloud solution to the overall firm output?
	Criticality and importance
	1. Determine the asset(s) for cloud computing deployment: • Which asset(s) are needed for cloud computing deployment (data, software, processes and/or combination of these)?
	2. Evaluate the asset(s) and their benefits based on their criticality and importance: • How important is the use of the asset(s)? • What are the potential risks of using the asset(s)?
	Architecture and technology
	1. Determine the appropriate cloud architecture and technology:

	• What infrastructural and technological requirements are needed for the cloud deployment (network connectivity, storage, physical infrastructure, etc.)?
	2. Map the benefits to a potential deployment model: • Which cloud deployment model is appropriate for your asset(s) (private, public, hybrid or community)?
	3. Evaluate potential cloud service models and cloud providers: • Which cloud service model is most appropriate for the potential asset (SaaS, PaaS or IaaS)? • What level of control of the asset(s) do you require? • Which cloud provider provides the best cloud service for the intended asset(s)?
	Governance and compliance
	1. Establish a cloud governance framework, policies and align with existing IT environment: • What is the process for cloud computing governance, security and the measures of risk (such as legalities, data protection, risk assessment, etc.)?
	2. Identify compliance regulations applicable to the cloud solution: • Which internal security policies and compliance requirements are attached to the cloud environment? • How do you intend to manage risk?
	People and change
	1. Determine reaction of staff and stakeholders: • What are the reactions of staff about moving to a cloud environment? • Do staff have enough knowledge and skills to manage cloud services? • Are there established processes for assigning roles and responsibilities in a cloud environment?
	2. Evaluate change readiness for cloud adoption: • Is there an adoption roadmap to be followed? • Is there any expectation whilst in the cloud? • Is the firm ready for the migration to the cloud environment?
	Business case
	1. Document benefits, proposed architecture, relationships and potential data flow: • What are the benefits for adopting cloud services? • How is the data flow between your firm, cloud provider and any other customers?
	2. Build a detailed business case: • Is there any detailed business case that will ensure the approval and acceptance of cloud services in your firm?

Thus, it is believed that when the benefit identification and evaluation guideline are utilized, implementing cloud solutions would be successful for SMEs. The development of the benefit and driver identification and evaluation guideline as indicated in figure 7.3 forms the fifth step in the development of the proposed cloud computing adoption framework components as shown in figure 7.5.

The next sub-section discusses the adoption concern and barrier identification and evaluation guidelines.

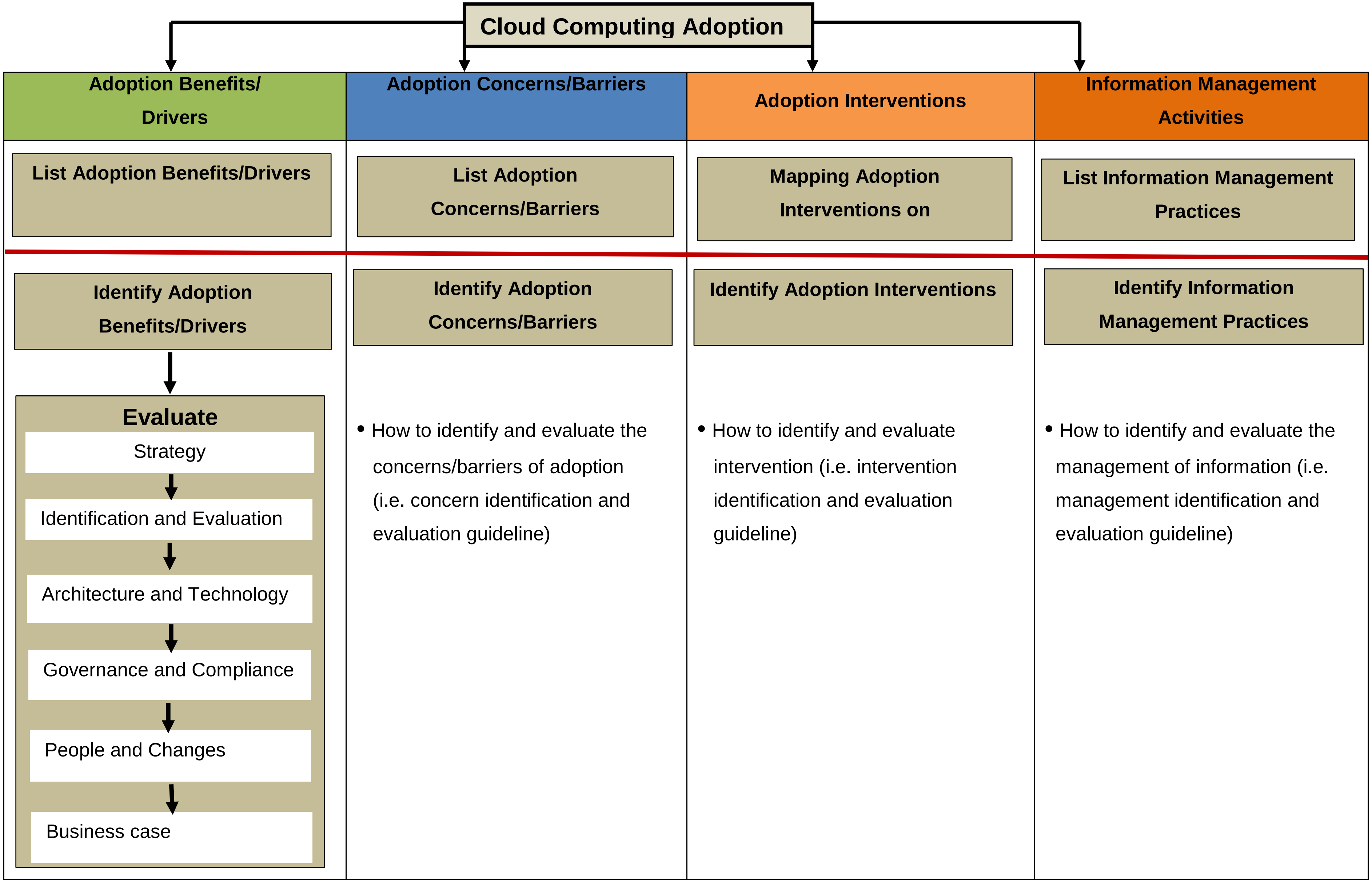


Figure 7.5: Development of adoption framework components (Source: Own Creation)

7.5.2.2 Adoption Concerns and Barriers Identification and Evaluation Guidelines

This section focuses on the guidelines for the identification and evaluation of cloud computing concerns and barriers. For the current study, the concern and barrier evaluation is broken into two objectives namely to identify cloud computing adoption concerns and barriers and to evaluate the identified concerns/barriers (through concern evaluation). Therefore, the concern and barrier identification and evaluation guideline provides potential cloud computing users the directions to identify and evaluate cloud computing adoption concerns and barriers.

The two objectives of the barrier and concern identification and evaluation guidelines are:

1. *Identify cloud computing adoption concerns and barriers:* Concern identification is the act of finding, listing and characterizing the concerns. Thus, it is to determine what could potentially cause a worry or anxiety, and how, where, or why the worry occurs. The identification of cloud computing adoption concerns may come from relevant policies, threat factors, system events or vulnerabilities. The concerns and barriers identified from the empirical study are presented in figure 7.2 and discussed in section 7.3 and can be used as a baseline.

2. *Evaluate the identified adoption concerns and barriers:* The evaluation of adoption concerns and barriers is done mainly through concern valuation.

Concern evaluation: In concern valuation, appropriate concern responses are suggested depending on the level of the concern and the acceptance criteria. The process includes comparing the level of the concern against the concern acceptance criteria of the firm, choosing the best concern handling options, and prioritizing the concern. Concern handling options include to overcome the concern, to mitigate the concern, or to accept the concern. Table 7.2 provides a description of the concern handling options.

Table 7.2: Concern Handling Options (Source: Own Creation)

Option	Description
Overcoming concerns	Adoption concerns becomes eminent when cloud service providers are not able to demonstrate their capabilities to provide services in a secure and reliable manner. To overcome the effect of adoption concerns on the adoption decision making process, users must understand their own accountability for security and compliance and their responsibility for implementing the necessary controls to protect their assets (ISACA, 2009). Cloud service providers also need to understand that their survival depends on meeting the expectations of users and therefore the need for them to have their services delivered in a secured and reliable manner to make them the preferred partner.
Concern mitigation	Concern mitigation has to do with actions taken to reduce the effect of using cloud services. It involves applying appropriate interventions to reduce the level of concern. Thus, concerns are identified and actions taken to reduce the level of the concern (ISACA, 2009). The concern is often limited by applying

	appropriate interventions to reduce the effect of the concern (i.e. using supportive and preventative interventions).
Concern acceptance	Concern acceptance relates to accepting the outcome of an expressed concern. This is where no action is taken relative to a particular concern, and loss is accepted when or if it occurs (ISACA, 2009). Thus, users knowingly and objectively accept the concerns.

The concern and barrier identification and evaluation guideline were developed based on the two concern and barrier objectives, namely: (Identify cloud computing adoption concerns and barriers and evaluate the identified adoption concerns and barriers), and the outcome of the empirical studies. Table 7.3 presents the cloud computing adoption concern and barrier identification and evaluation guidelines, broken down into the objectives and sub-objectives.

Table 7.3 Concern/barrier identification guidelines (Source: Own Creation)

Objective	Sub-objective
Identify cloud computing adoption concerns/barriers	List and characterize the identified concerns and barriers and then determine whether the concern could potentially cause a worry or anxiety, and how, where, or why the worry occur. For the current study, the identified concerns and barriers from the empirical work are discussed in section 7.3. This is used as the baseline. Possible questions to consider include: • Which instances and events will cause a concern? • What level of concern could have a potential adverse effect on the business? • What existing plans are in place to reduce the level of concern?
Evaluate the Identified concerns and barriers	***Concern Valuation***
	Determine an appropriate concern handling option or response to the identified concern or barrier. Questions that may arise include: • How is the concern related to the overall business opportunity? • What is the acceptance principle applicable to the concern? • How will the concern be handled?

The concern and barrier guidelines are supposed to give guidance for cloud computing adoption concern and barrier identification and evaluation. The concern and barrier identification and evaluation guidelines forms the sixth step in the development of the cloud computing adoption framework components which is shown in figure 7.6.

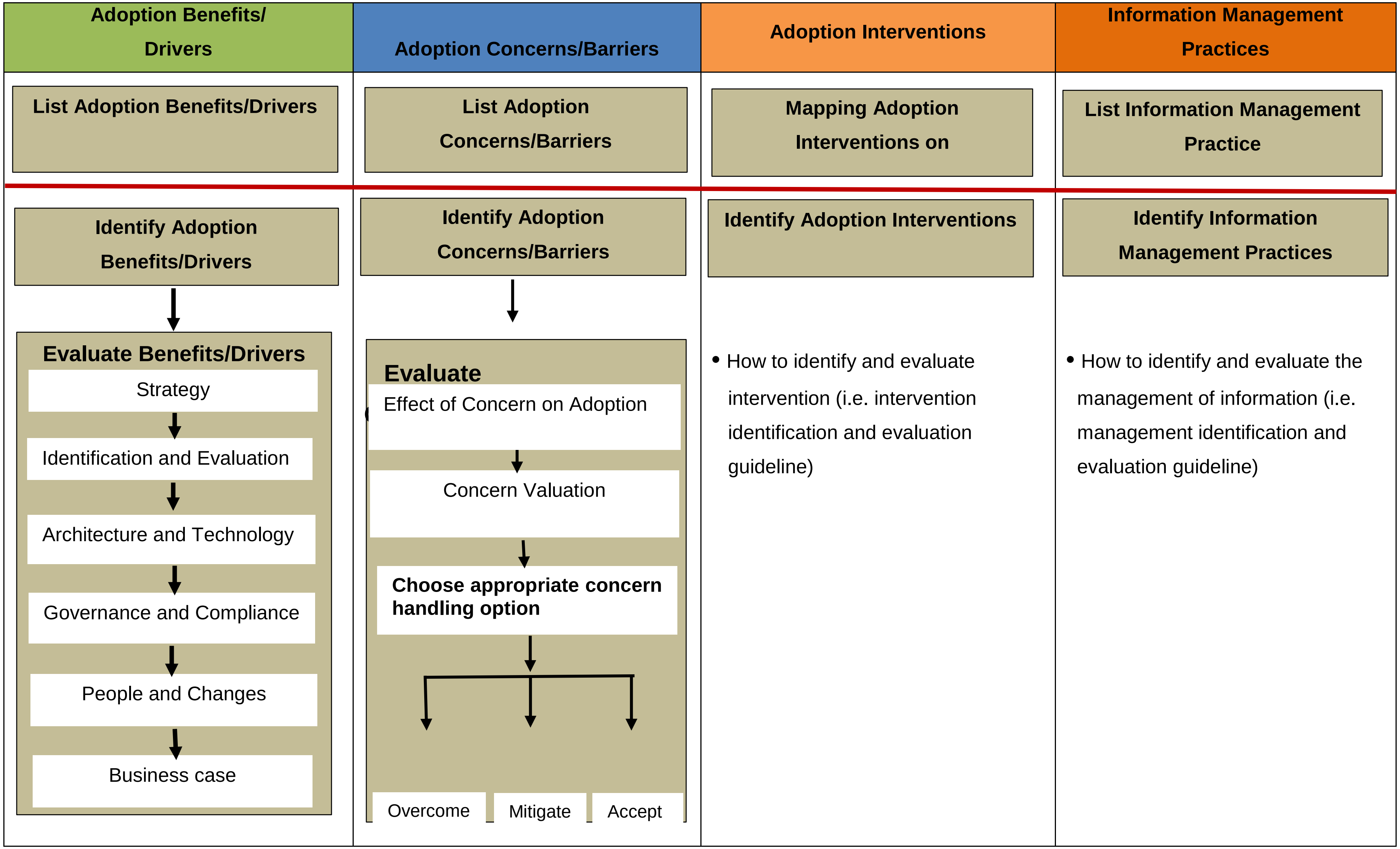


Figure 7.6: Development of adoption framework components (Source: Own Creation)

7.5.2.3 Adoption Intervention Identification and Evaluation Guidelines

This section discusses the identification and evaluation guidelines for cloud computing adoption interventions. The current study identifies two objectives for this stage, namely to identify the adoption interventions, and to evaluate the identified interventions. The identification and evaluation guidelines help to properly identify and evaluate cloud adoption interventions. This will ensure that the effect of the concerns and barriers do not considerably affect the process of achieving the business goals.

The intervention identification and evaluation guideline objectives for the study include:

1. *Identify cloud computing adoption interventions:* The process of intervention identification involves identifying an appropriate intervention or interventions for a or concern or barrier. The mapping of cloud computing adoption interventions identified from the empirical study and presented in the initial adoption model presented in figure 7.2 served as the reference point for the identification and mitigation interventions.

2. *Evaluate the identified interventions:* This objective includes the evaluation of the selected interventions to see how effective they are. This will ensure that interventions are implemented correctly, operate as expected, and produce the desired result of mitigating the identified concern. When the intended objective for using an intervention is achieved, the intervention is said to be effective. An assessment of the implemented intervention is conducted to identify any weakness in the intervention.

The intervention identification and evaluation guideline was developed based on the two objectives, namely: (Identify cloud computing adoption interventions and evaluate the identified interventions), and the outcome of the empirical studies. Table 7.4 presents the guidelines for the identification and evaluation of the cloud computing adoption interventions, broken into the objectives and sub-objectives.

Table 7.4: Intervention identification and evaluation guidelines (Source: Own Creation)

Objective	Sub-objective
Identify cloud computing adoption interventions	Select baseline interventions for each identified concern or barrier. Use the mapping of cloud computing adoption interventions in figure 7.1 as baseline. Typical issues and questions which arise include: • Which intervention is most appropriate for a particular concern or barrier?
Evaluate the identified interventions	Determine the effectiveness of interventions. Typical issues and questions which arise include: • What is the ideal method of intervention evaluation? • What are the potential weakness in existing interventions? • Is the intervention implemented as required?

	• Is the intervention operating as expected? • Is the intervention able to produce the desired results?

The identification and evaluation guidelines depicted in table 7.4 were mapped to the adoption interventions from figure 7.2.

Table 7.5: Mapping adoption concerns and barriers to interventions using intervention identification and evaluation guideline (Source: Own Creation)

Concern/barrier	Intervention
Integration	It is expected that the standardization of cloud application programming interfaces (APIs) will help with the integration of distinct platforms with different interfaces and protocols to improve the economic and efficiency gains the cloud offers.
Data control	It is expected that service providers will continually reassure users of uninterrupted access to their data. When users have uninterrupted access to their data, there is a perception by the user of having control of their data. If users perceive they are in control, they are more likely to trust in cloud computing services and hence adopt and use the service.
Data Confidentiality	It is expected that service providers will put measures in place to ensure user's data is kept confidential and to enhance trust between the service provider and the user. Failure to ensure data confidentiality will have a negative impact on the user's trust in the cloud computing service. It is also expected that policies and procedures shall be established to articulate who is authorized to have access to data and ensure timely and thorough incident management. Additionally, authentication and access control strategies can be implemented to ensure data confidentiality. This will increase trustworthiness in the cloud.
Security Concern	It is expected that service providers will implement effective, efficient and operationally functional data protection techniques. The continued existence of security measures by the service provider improves the user's perceptions of the service provider's ability to maintain the confidentiality, integrity and availability of the stored data on a cloud platform.
Privacy Concerns	The sharing nature of cloud computing and open nature of the Internet makes data in transit susceptible to uncontrolled access. There must be guarantees from the service provider that user's data will not be used for any unintended purposes, as issues of privacy in the cloud mostly relates to the breach of trust. Also, privacy laws and regulations can be implemented to protect data.
Unreliable Internet Connection	The technical infrastructure regarding broadband connectivity negatively impacts on the 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.
Power Outages	The infrastructure for the generation of a reliable power supply is lacking and therefore affects the adoption of cloud computing. There is therefore a need for basic infrastructure for generating power to ensure constant availability of cloud services.
Legal and Regulatory Uncertainties	Cloud services impact on a range of regulatory aspects both within and across jurisdictions. It is expected that regulators will establish information regulatory procedures and coordinate regulatory decision-making that is targeted at cloud service providers and users of cloud services.
Lack of Knowledge and Technical Skills	There is an obstacle of acquiring appropriate skills and technical knowledge in the deployment of cloud services. It is expected that businesses will develop the necessary skills and knowledge to deliver the benefits it expects from the cloud.

The identified interventions were evaluated for adequate design and implementation, which measures the effectiveness of the intervention and appropriateness of the implementation process. Additionally, the interventions were evaluated for operational effectiveness to establish if the interventions operate as designed. The intervention identification and evaluation guidelines form the seventh step in the development of the cloud computing adoption framework components and is shown in figure 7.7.

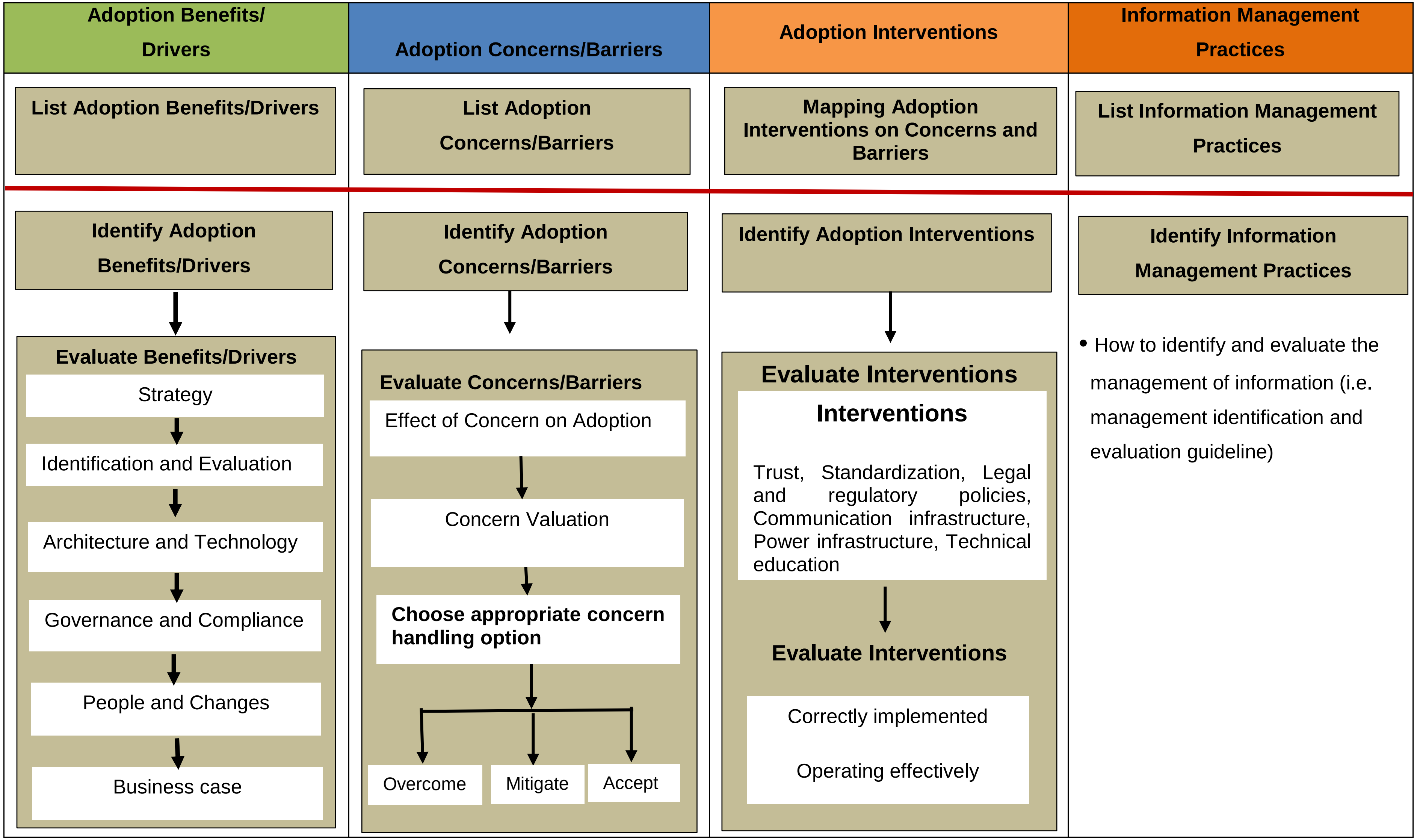


Figure 7.7: Development of adoption framework components (Source: Own Creation)

7.5.2.4 Information Management Activity Identification and Evaluation Guidelines

The study identifies two objectives for this stage, namely to identify the information management activities, and to evaluate the identified information management activities. The identification and evaluation guidelines at this stage will provide direction to identify and evaluate information management activities in a cloud environment. This will improve information practices to enhance the use of cloud services.

The information management activities identification and evaluation guideline objectives for the study include:

1. *Identify information management practices in a cloud environment:* Information management activity identification includes identifying the processes and policies for both understanding how information is used, and governing the usage. The identification of activities for managing information in a cloud computing environment may come from relevant policies, skills, capabilities, and mind-sets required of the user. The information management practices identified from the empirical study are presented in figure 7.2 and discussed in section 7.3 and this can be used as a baseline.

2. *Evaluate the identified information management practices:* The evaluation of the selected information management practices is done through the classification and categorization of the information that is to be shared.

The classification of information goes through four stages:

1. *Creation:* Information gets created and the creator of the information determines whether to implement access control on the information.

2. *Share:* Information is made accessible to others such as users, even though the information may in transit be subjected to deferent levels of threat.

3. *Update:* The updater of information must consider the content of the information they are updating and make a decision as to whether or not the changes present additional and/or modified information protection requirements.

4. *Deletion:* The deletion of information should mirror its classification and impact sensitivity considerations. If the information is considered to be securely destroyed then just placing it in the system waste is not acceptable.

The categorization of information covers two phases:

1. *Storage:* Information must be stored to reflect the information protection requirements. If the information is highly classified or has high impact sensitivity, then confidentiality must be considered.

2. *Data transfer:* The protocols for transferring information between collaborative entities should take into consideration the information protection requirements. If the information is highly classified or has high impact sensitivity then confidentiality assurance must be taken into account.

The information management practice identification and evaluation guideline was developed based on the two objectives, namely: (Identify information management practices and evaluate the identified information management practices), and the outcome of the empirical studies. Table 7.6 presents the guidelines for the identification and evaluation of the information management practices, broken into the objectives and sub-objectives.

Table 7.6: Information management practice identification and evaluation guideline (Own Creation)

Objective	Sub-objective
Identify information management practices	List and characterize the identified information management practices and determine how the information is processed and used, and the policies governing its usage. For this study, the identified information management practices are discussed in section 7.3. This is used as the baseline. Possible questions to consider include: • Who accesses the data? • How can they access it? • What policies defines allowed activities for different information types?
Evaluate the identified Information management practices	***Information classification***
	Determine an appropriate information protection requirements for the identified information management practice. Possible questions to consider include? • What are the information handling requirements? • What are the legalities and temporal aspects to be considered? • Who is ultimately responsible for managing the information?
	Information categorization
	Determine the controls required to maintain information assurance in a de-perimeterised environment. Possible question to consider include: • What controls are required for confidentiality assurance?

The identified information management practices were evaluated to understand the processes for using information and the policies governing their usage. Additionally, the evaluation was done to maintain control over the information and thereby maintain control of sensitive business information.

The information management practice identification and evaluation guideline forms the eighth step in the development of the cloud computing adoption framework components as shown in figure 7.8.

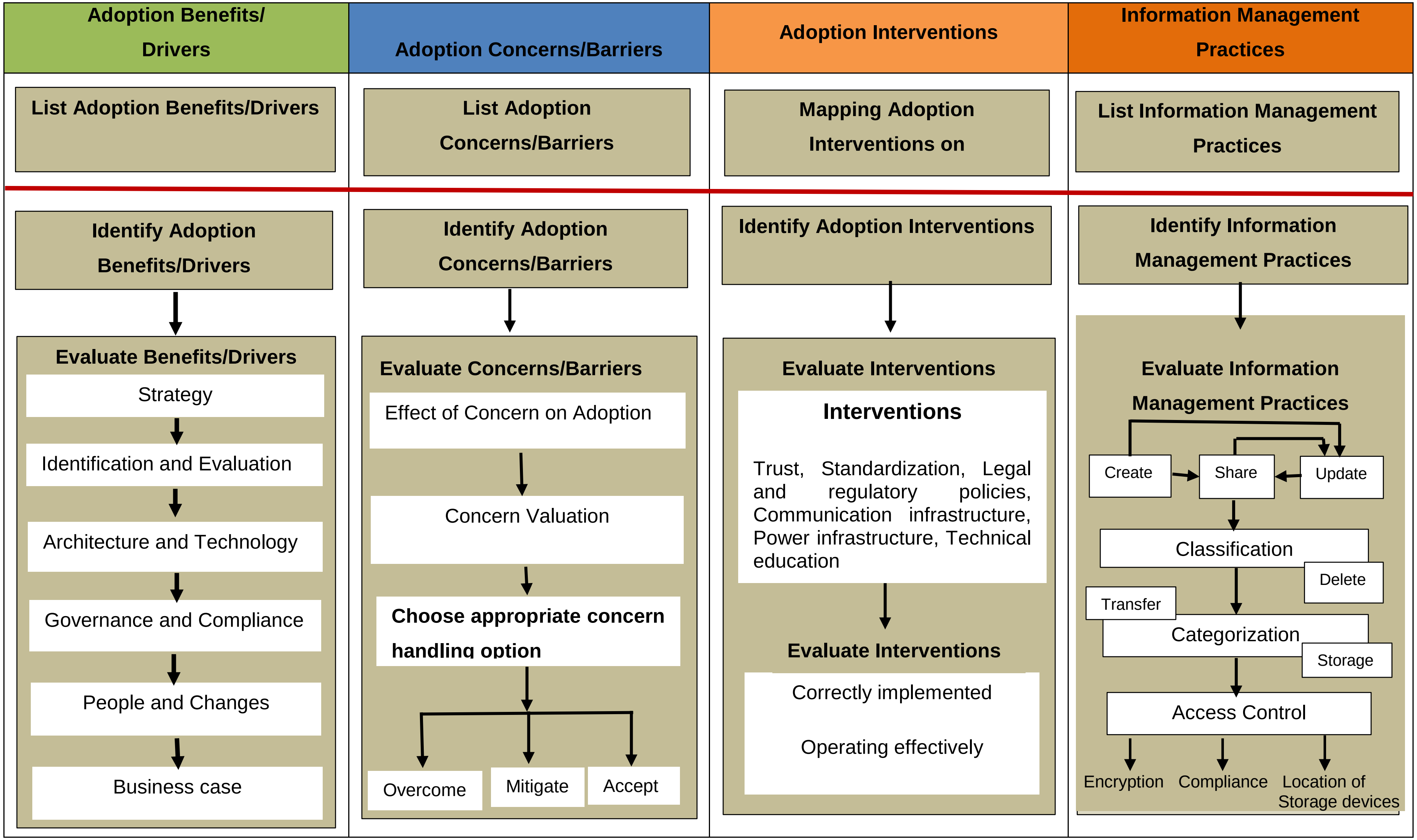


Figure 7.8: Development of adoption framework components (Source: Own Creation)

The access controls should be able to respond appropriately to the information security requirements of classification stage and the impact sensitivity categorization stages.

From figure 7.3, the next step is to integrate the identified adoption framework components into a functional unit and to develop guidelines for carrying out an assessment of a cloud computing environment. The next section discusses this step.

7.5.3 Integration of the Identified Cloud Computing Adoption Framework

This section focuses on the expansion of the basic structure of the model into a functional unit through the integration of the identified cloud adoption framework components and establishing relationships between the identified components. From the design and development stage of the design science research process, the basic structure of the framework identified eight components:

1. List of adoption benefits and drivers.
2. List of adoption concerns and barriers.
3. Mapping of adoption interventions to concerns and barriers.
4. List of information management practices.
5. Adoption benefit and driver identification and evaluation guideline.
6. Adoption concerns and barrier identification and evaluation guideline.
7. Adoption interventions identification and evaluation guideline.
8. Information management practices identification and evaluation guideline.

The adoption framework components were grouped according to focus areas as follows:

1. *Adoption benefits and drivers:* A benefit is the value realized after using the cloud services in line with the business strategies and objectives, while optimizing costs. The adoption benefit and driver identification and evaluation guidelines (Table 7.1) seeks to help firms to decide whether cloud computing is a better solution to optimize the infrastructure. The list of adoption benefits and drivers discussed in section 7.3 can be used as the reference point for the identification of benefits and drivers in this study.
2. *Adoption concerns and barriers:* The concern and barrier identification and evaluation guidelines (Table 7.3) provides potential cloud computing users the directions to identify and evaluate cloud computing adoption concerns and barriers. The list of

adoption concerns and barriers discussed in section 7.3 can be used as the baseline for the identification of concerns and barriers in this study.

3. *Adoption interventions:* The identification and evaluation guidelines (Table 7.4) helps to properly identify and evaluate cloud adoption interventions. This will ensure that the effect of the concerns and barriers do not considerably affect the process of achieving the business goals. The mapping of cloud computing adoption interventions identified from the empirical study and presented in the initial adoption model (figure 7.2) can be used as the baseline for the identification and mitigation interventions.

4. *Information management practices:* The identification and evaluation guidelines (Table 7.6) at this stage will provide direction to identify and evaluate information management activities in a cloud environment. This will improve information practices to enhance the use of cloud services. The information management practices identified from the empirical study presented in figure 7.2 and discussed in section 7.3 can be used as a baseline for this study.

The eight identified framework components are graphically shown in in figure 7.8. Relationships between the identified components are then established. This interrelationship between the identified components of the adoption framework are presented in figure 7.9.

From figure 7.9, the identification and evaluation of adoption benefits and drivers becomes relevant when considering whether cloud computing solution is best for optimizing the firm's IT environment and achieve cost benefits. This is usually done before the adoption process. Thus, this is a pre-adoption activity.

However, the identification of the adoption concerns and barriers, and intervention implementation is done when one want to assess how well the concerns and barriers are understood the firm, the significance of the concerns and barriers, and how management respond to the concerns and barriers and to mitigate those concerns and barriers. These activities are performed during or after the adoption process. Thus, they are post, or during, adoption activities.

The identification of information management practices is done when the firm wants to know how their data is managed, measures put in place to protect the data, and how data can easily be transferred to them from the provider's platform. This is done after the adoption process. Thus, this is a post-adoption activity.

The activities of identification and evaluation can be performed in isolation (i.e. only pre-adoption identification and evaluation of adoption benefits) or in combination (i.e. identifying the adoption concern and identifying mitigating intervention after evaluating the concern (concern response). This can then be followed evaluating the interventions for correct implementation and operating effectiveness).

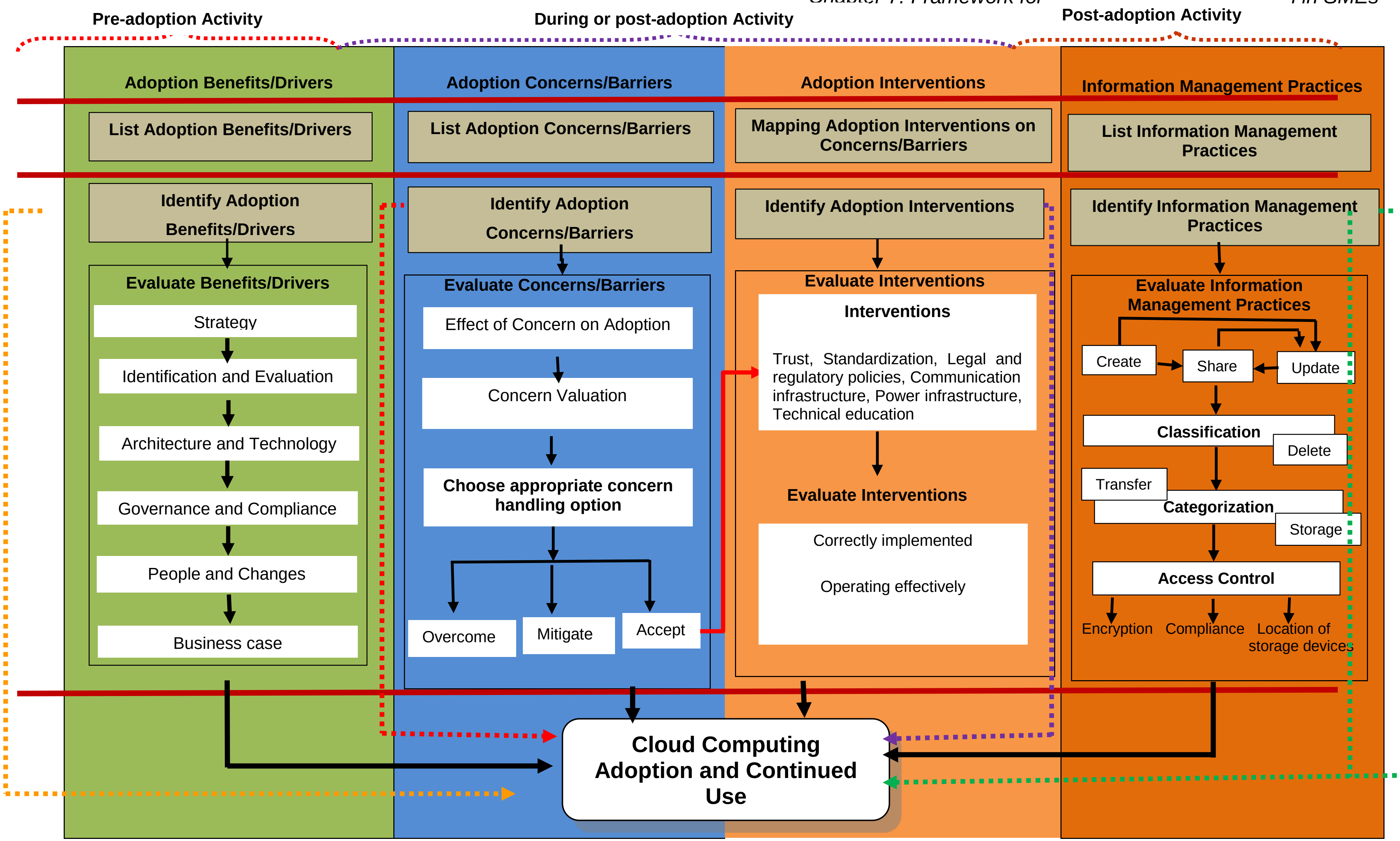


Figure 7.9: Identified adoption components and their interrelationships (Source: Own Creation)

Figure 7.9 shows the integration and establishment of interrelationships between the cloud adoption framework components. The next step is to develop guidelines for assessing the cloud computing environment and a method to be used in order to apply the adoption framework.

7.5.4 Guidelines for Assessment of the Cloud Computing Environment

This section focuses on the development of a method for applying the adoption framework. This will be in the form of guidelines for the assessment of the cloud environment. The guidelines indicate how to understand, identify, evaluate and report on cloud computing adoption benefits and drivers, concerns and barriers, adoption intervention, and the management of information in a cloud environment.

The adoption assessment guidelines should be in line with the identified adoption framework components and the implementation steps should be adjustable to suit the business needs of SMEs. The assessment guideline comprises four steps.

1. Assess the relevant cloud environment and consider the adoption strategy. This is to ensure a successful adoption process.

2. Understand the relevant cloud environment and list the identified adoption factors applicable to the environment (i.e. adoption framework components). This is to allow for a better understanding of the cloud computing environment and how these adoption factors affect the environment.

3. Evaluate by reviewing the identified adoption factors (adoption framework components). This can be done through observations, review of documentation, testing for effectiveness and verification.

4. Draw a reasonable conclusion of the assessment. This may include documenting both the negative and positive effects of the adoption factors on the overall adoption, make recommendations and make this available to stakeholders. Monitoring and evaluation of the effectiveness of the intervention on concerns and barriers should be a continuous process.

The assessment guideline steps are graphically presented in figure 7.10.

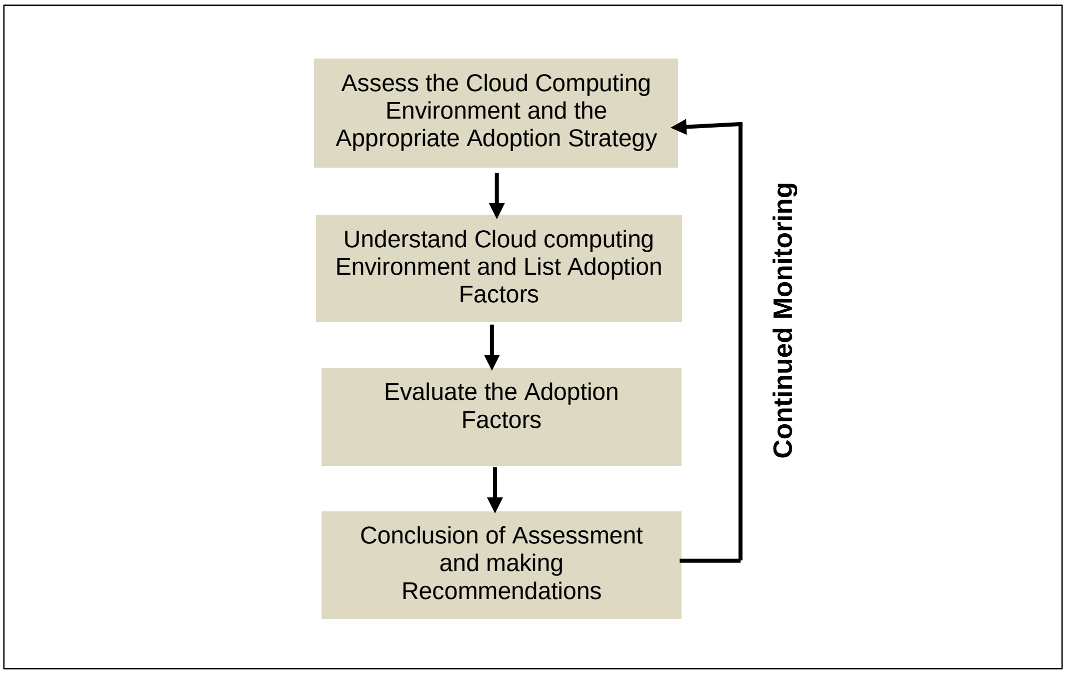


Figure 7.10: Cloud computing environment assessment guideline steps (Source: Own Creation)

As mentioned above, the cloud computing assessment guidelines comprise of objectives and sub-objectives. Table 7.7 gives a description of the objectives and sub-objectives making up the cloud computing assessment guidelines.

Table 7.7: Cloud computing environment assessment guidelines (Source: Own Creation)

Objectives	Sub-objectives
Define the assessment objectives	• List all the objectives related to the assessment of the cloud computing environment.
Determine the assessment strategy	• Determine the assessment goals. • Determine the approach to the assessment of the cloud computing environment. • Determine the assessment roadmap to allow for measurable benefits. • Determine what is expected to be established from the assessment.
Determine the resources Required for the assessment	• List all resources required for the cloud environment assessment. • Determine resources that are in shortage (i.e. human skills, infrastructure, capital, etc.). • List all resources already available to aid a successful assessment. • Make arrangements to provide any other required resource.
Get better understanding of the cloud computing environment	• Enquire about the business processes. • Obtain information about existing IT infrastructure (i.e. policies, regulations, licenses, configurations, settings, network architecture, chain of command, authentication credentials, procedures, etc.). • Describe existing service agreements and the terms. • Obtain information about service providers and the service they provide (i.e. location, type of cloud service they provide, jurisdictions, exact location of server hosting service, etc.).
Document all relevant information regarding the cloud computing	• Document all relevant information about the cloud computing environment.

environment	
Identify the adoption factors	• List all the identified cloud computing adoption factors and explain the effect of each factor on adoption. • Implement the identification and evaluation guidelines for each for factor.
Evaluate the identified adoption factors	• Evaluate all the identified adoption factors. • Implement the identification and evaluation guidelines for each for each factor. • Test the adoption interventions for adequacy and operational effectiveness. • Develop a strategy and plan for infrastructure maintenance.
Conclude the assessment and make recommendations	• Document and conclude the assessment by making recommendations including possible monitoring procedures. • Make recommendations available to stakeholders.

The cloud computing environment assessment guidelines completes the final stage of the development of the cloud computing adoption framework. The next section presents the final cloud computing adoption framework.

7.6 Final Cloud Computing Adoption Framework

The outcome of the empirical studies informed the development of the cloud computing adoption framework. The outcome of the empirical study showed that the decision to adopt cloud computing services by SMEs in the Accra-Tema metropolis of Ghana is strongly influenced by certain factors. The various adoption factors were categorised into four, namely: benefits and adoption drivers, concerns and adoption barriers, adoption interventions and information management practices on the cloud platform. These serve as the core components of the framework. The components were integrated and interrelationships established to develop a final framework that can assist through guidelines to identify and evaluate cloud computing adoption benefits, concerns, interventions and information management practices.

Figure 7.11 presents the final cloud computing adoption framework.

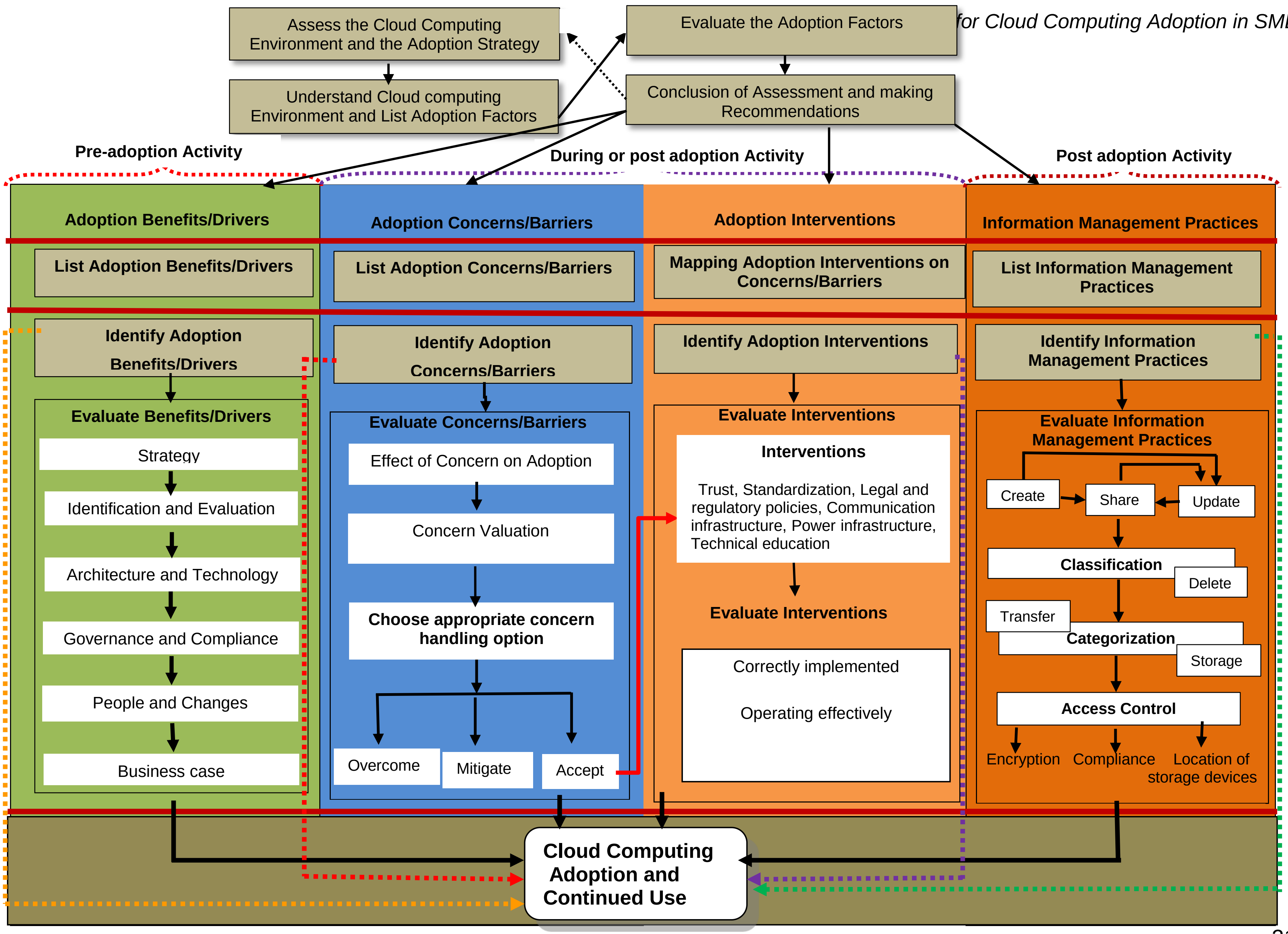


Figure 47.11: Final cloud computing adoption framework (Source: Own Creation)

The cloud computing adoption framework describes the effect of the four main adoption factors (namely: adoption benefits and drivers, adoption concerns and barriers, adoption interventions, and information management practices in a typical cloud environment).

A benefit is the value realized after using the cloud services in line with the business strategies and objectives, while optimizing costs. These benefits and drivers are first identified and evaluated before the actual adoption occurs (thus a pre-adoption activity). The adoption benefit and driver identification and evaluation guidelines seeks to help firms to decide whether cloud computing is a better solution to optimize the infrastructure. The identification and evaluation guidelines can be broken down into two objectives:

1. *Identify cloud computing benefits and adoption drivers:* The process of identification includes finding, listing and characterizing the benefits of cloud computing. The benefits and drivers of cloud computing resulting from the empirical study are accessibility, flexibility, agility, reduced cost, efficiency, reduced IT staff, and reduced system administration, support, reduced expenditure on software and hardware and automatic backups. These can be used as the baseline.

2. *Evaluate the identified benefits and adoption drivers:* In evaluating the benefits and drivers of cloud computing adoption, six critical areas such critically and importance, architecture and technology, governance and compliance, people and changes, and business case must be taken into consideration.

Cloud computing adoption is underpinned by uncertainties and concerns. The concerns and barriers of adoption are identified and evaluated during or after adoption (thus a during or after adoption activity). The identification and evaluation guidelines can be broken down into two objectives.

1. *Identify cloud computing adoption concerns and barriers:* The process of identifying adoption concerns and barriers involves finding, listing and characterizing the concerns and barriers. The concerns and barriers identified from the empirical study are integration, data control, data confidentiality, privacy concern, security concern, unreliable Internet connectivity, power outages, legal and regulatory uncertainty, and the lack of knowledge and technical skills. These can be used as the baseline.

2. *Evaluate the identified adoption concerns and barriers:* The evaluation of adoption concerns and barriers is done through concern valuation. In concern valuation, appropriate concern response are applied based on the level of the concern and acceptance criteria.

Adoption interventions are measures put in place to ensure a successful adoption process that will result in businesses meeting their objectives. These measures are implemented during or after adoption (thus a during or post adoption activity). The identification and evaluation guidelines provide a means to identify and evaluate cloud adoption interventions. This will ensure that the effect of the concerns and barriers do not considerably affect the process of achieving the business goals. The intervention identification and evaluation guideline objectives for the study include:

1. *Identify cloud computing adoption interventions:* The process of intervention identification involves choosing an identified intervention or interventions that best respond to an identified concern and barrier and finally identifying the appropriate intervention for particular concern or barrier. The mapping of cloud computing adoption interventions identified from the empirical study and presented in the initial adoption model presented in figure 7.1 can be used as the reference point for the identification and mitigation interventions.

2. *Evaluate the identified interventions:* The interventions are evaluated to ensure their operational effectiveness.

The study identifies two objectives for the stage of managing information, namely to identify the information management activities and to evaluate the identified information management activities. The identification and evaluation guidelines at this stage will provide directions to identify and evaluate information management activities in a cloud environment. This will improve information practices to enhance the use of cloud services.

The information management activities identification and evaluation guideline objectives for the study include:

1. *Identify information management practices in a cloud environment:* Information management activity identification includes identifying the processes and policies for both understanding how information is use, and governing that usage. The identification of activities for managing information in a cloud computing environment may come from relevant policies, skills, capabilities and mind-sets required of the user. The information management practices identified from the empirical study are discussed in section 7.3 and this can be use as baseline.

2. *Evaluate the identified information management practices:* The evaluation of the selected information management practices is done through the classification and categorization of information that is evaluated to understand the processes for using

information and the policies governing their usage. Additionally, the evaluation was done to maintain control over the information and thereby maintain control of sensitive business information.

The cloud computing adoption framework components are then interrelated to produce a functional unit and assessment guidelines developed to offer direction for planning, evaluation and reporting of cloud adoption factors (benefits and drivers, concerns and barriers, adoption interventions and information management practices). The development of the assessment guidelines begins by assessing the cloud computing environment and deciding on the appropriate adoption strategy. This helps to get a better understanding of the adoption environment including the adoption factors (i.e. benefits and drivers, concerns and barriers, adoption interventions, and information management practices), and evaluating these factors through reviews. The assessment concludes with recommendations that are communicated to the parties concerned. There is a continuous update, monitoring and review throughout the process to make for changes in the environment.

7.7 Guidelines to Perform a Cloud Computing Adoption Assessment

The final cloud computing adoption framework is meant to serve the needs of professionals from diverse background. For IS professionals and business managers, it can help facilitate their evaluation and mitigation of concerns associated the adoption of cloud computing. For those in the area of IT governance, the framework can assist them to come out with appropriate policies, procedures and interventions to protect and maintain asserts and to achieve business value and optimization of through the alignment of business and IT goals. For cloud service providers, this framework presents a means of assuring customers that cloud environments and services are adequately and effectively protected against risks and also to bring to forth any potential weaknesses in their provision of cloud services to customers. IT assurance practioners can use the framework as a guide in carrying out assurance and risk-based assessment in cloud computing.

The use of a cloud adoption assessment guideline provides such professionals a guidance to plan for, identify, evaluate and report on cloud computing benefits and drivers, concerns and barriers, information management practices, and interventions. The cloud assessment guideline was developed based on the Plan, Do, Check, Act (PDCA) cycle first proposed by Deming (Moen & Norman, 2006). The cycle consist of four steps: the **Plan** step, the **Do** step, the **Check** step and the **Act** step. Each step consist of objectives and sub-objectives that offer guidance and direction to perform an assessment of a cloud environment.

Plan: This is the first step and involves the planning of the assessment through fact-gathering and pre-fieldwork preparations. The step help ensure the successful assessment of the cloud computing environment. The Plan step consist of five objectives:

1. Establish the adoption framework assessment objectives.
2. Establish the adoption framework assessment scope.
3. Establish the adoption framework assessment resource requirements.
4. Establish the adoption framework assessment deliverables.
5. Document the key assumptions and considerations for the adoption framework assessment.

Do: Collect information and relevant documentation for review and scrutiny and identify cloud computing adoption benefits and drivers, concerns and barriers, information management practices and adoption interventions. This step consist of three objectives:

1. Obtain and understanding of the cloud computing environment under review.
2. Collect and record appropriate information and documentation.
3. Identify benefits and drivers, concerns and barriers, information management practices, adoption interventions (depending on the scope). It is suggested to use the benefit and driver identification and evaluation guideline, the concern and barrier identification and evaluation guideline, the information management practice identification and evaluation guidelines, and the adoption intervention identification and evaluation for guidance on the identification of the cloud computing benefits and drivers, information management practices, concerns and barrier, and adoption interventions.

Check: This step involves the review and scrutiny of the identified cloud computing benefits and drivers, information management practices, concerns and barriers, and adoption interventions. This step has one objective:

1. Evaluate the identified benefits and drivers, information management practices, concerns and barriers, and adoption interventions (depending on the scope). It is suggested to use benefit and driver identification and evaluation guideline, the concern and barrier identification and evaluation guideline, the information management practice identification and evaluation guidelines, and the adoption intervention identification and evaluation for the evaluation of the identified cloud

computing benefits and drivers, information management practices, concerns and barrier, and adoption interventions.

Act: This is the final step and entails the reporting, wrap-up and conclusion of the assessment. This step has one objective:

1. *Report, follow-up and conclude the assessment:* Based on the PDCA cycle, the cloud computing adoption assessment process (guidelines) can begin with establishing the objectives, scope, resource requirements, deliverables, key assumptions and considerations (Plan). That is, the sort of applications, processes, procedures, technologies, services, and data to be included in the scope. Once the assessment plan is developed, there is the need for the understanding of the cloud computing environment under review (the type of cloud computing service, relevant business processes, vendors, jurisdiction, etc.). Based on the assessment plan and scope, a choice can be made between alternatives:

2. *Using adoption benefits and drivers:* This is the identification and evaluation of cloud computing adoption benefits and drivers to assist firms in deciding whether cloud computing service is ideal for adoption based on the understanding and assessment value. The outcome from the identification *(Do)* and evaluation *(Check)* of cloud computing benefits and drivers is recorded in a report to management *(Act)* and conclude the assessment. Alternatively, if the assessment seeks to identify the benefits and drivers only, then the assessment ends after the identification of the benefit and drivers. Thus, the exclusion of the evaluation of benefits and drivers. The assessment (review) can exist at this point or reported to management *(Act).*

3. *Using adoption concerns and barriers:* After gaining a good understanding of the cloud computing environment, the assessment identify *(Do)* cloud computing concerns and barriers relevant to their environment and evaluate *(Check)* the impact and likelihood of the identified concerns and barriers based on the firm's policies and procedures and appetite for concern and barrier. Depending on the nature of the concern and barrier, an appropriate response is selected to bring the concern and barrier in line with the defined concern and barrier desire of the firm (i.e. within the defined tolerance limits). The outcome from the identification *(Do)* and evaluation *(Check)* of cloud computing concerns and barrier is reported to management *(Act).* The report can either end the assessment, or the concern and barrier responses can be use to as input for the identification and evaluation of adoption interventions (combined approach). Alternatively, if the assessment aims at the identification of

concerns and barriers only, then the assessment ends after the identification of the concerns and barriers. Thus, the exclusion of the evaluation of concerns and barriers. The assessment can remain at this stage or recorded in a report for management *(Act).*

4. *Using information management practices:* With the understanding of the environment, the assessment identifies information management practices (Do) relevant to the environment and evaluate *(Check)* the issue of information management and its impact on the decision to adopt cloud computing. The findings from the identification *(Do)* and evaluation *(Check)* of information management issues is recorded in a report for management *(Act).* Another alternative is that, if the assessment aims at the identification of information management issues only, then the assessment ends after the identification of the information management issues. Thus, the exclusion of the evaluation of information management issues. The assessment can exist at this stage or recorded in a report for management *(Act).*

5. *Using adoption interventions:* With the understanding of the environment, the assessment identifies adoption interventions *(Do),* which would help in the mitigation of concerns and barriers and the achievement of the business objectives. The assessment can end at this stage or continue with the evaluation of adoption interventions for proper implementation and operating effectiveness *(Check).* The outcome from the identification *(Do)* and evaluation *(Check)* of cloud computing interventions is recorded into a report to management *(Act).* The report ends the assessment.

6. *Combination:* A combination of concerns and barriers and adoption interventions identification and evaluation is also an alternative. In this case, the adoption intervention assessment follows as a response (treatment option) to the identified concerns and barriers.

The scope and objectives (assessment plan) (Plan) should be continuously updated depending on the results of the assessment. Thus, depending on the identification and evaluation of the concerns and barriers, the scope may require adjustment. The scope and objectives should also be updated and references made for future assessments depending on the outcome of the reporting step *(Act).*

As a proof-of-concept of the cloud computing adoption framework, a typical SME in Ghana can apply the assessment guideline to the adoption of cloud computing application as depicted in table 7.8

Table 7.8: Example of the use the cloud computing assessment guideline to assess a cloud application at SME G1

Plan	• Establish the adoption framework assessment objectives, scope and the expected deliverables: • The assessment scope and objectives are meant to identify and evaluate interventions for the concerns and barriers considered critical to SME G1 for that particular cloud application. Test interventions for adequate implementation and operating effectiveness. • Document all key assumptions and considerations. • The assessment is limited to concerns considered to have a critical impact on the SME G1.
Do	Interview some employees of different departments at SME G1. • Obtain an understanding of the cloud environment under review. • Description of the particular cloud application including cloud service model (example public cloud), related business processes, type of application, responsibilities, and jurisdiction. • Collect and record appropriate information and documentation for the identification of cloud computing concerns and interventions. • Obtain a concern register and identify (for example integration management) as a critical concern for SME G1. • Obtain the documented concern control policy (which include integration management procedures). • **Identify the concern and barrier** corresponding to integration management from the **List of cloud computing adoption concern and barrier:** Exploitation of known vulnerabilities associated with distinct platforms and protocols. Use the **Mapping of adoption concerns and barrier to interventions** to **identify the intervention** that mitigates the concern and barrier: Develop a strategy for obtaining infrastructure with standardized cloud APIs, ensure changes are done in line with SME's change management procedures. There should be regular reviews against the business needs, integration management, upgrade strategies, concerns, security requirements, vulnerability assessment.
Check	• Evaluate the identified adoption intervention for adequacy and impact on the cloud computing environment under review and the SME as a whole. • Determine any discrepancies between the change control policy and the integration management strategy • Review the change history of the cloud application to ensure that all the necessary integrations on a timely basis.
Act	• Report, follow-up and conclude the assessment • Meet with SME G1 management and discuss the assessment report that includes the results of the assessment and any weaknesses observed.

7.8 Evaluation of the Final Cloud Computing Adoption Framework

As per the design science research process, in order to demonstrate the applicability, usability and efficiency of the developed cloud computing adoption framework (artefact), it must be evaluated. As discussed in chapter 5, the study has three consecutive phases: questionnaire survey, interviews and expert reviews. Each phase was evaluated to inform the final adoption framework and iterated back to the design and development stage. The final framework was therefore evaluated by expert reviewers from technology and SME domains.

7.8.1 Criteria for Selecting Expert Reviewers

The research study aimed to develop a framework to assist SMEs to adopt cloud computing successfully. Experts were identified to validate the various components and relationships that exist amongst them. The experts were identified from the field of technology and small business management.

The selection of the experts was purposively done. According to Babbie (2008) in purposive sampling the researcher has to depend on his/ her own experience in order to select the unit of analysis. The experts selected should be able to provide valuable information towards the study. The uniqueness of purposive sampling is that it allows a researcher to select participants who provide the researcher with detailed information, and is therefore not aimed at providing a vast sample (Ladico, Spauding and Voegtle, 2010).

On expert evaluations of human-computer interactions, the use of three to five experts is acceptable to identify the errors present in heuristic evaluations (Nielson, 1993). The expected errors expressed as percentages are shown in figure 7.12.

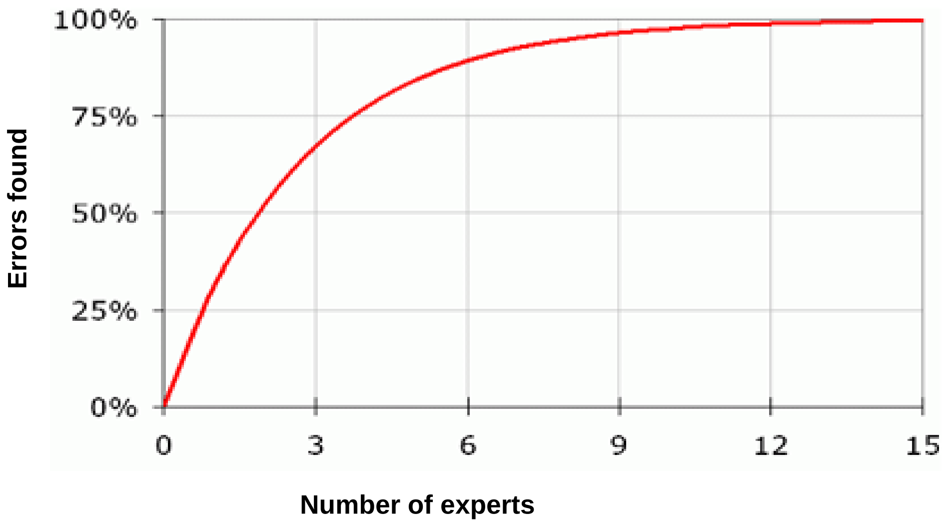


Figure 7.12 Error detection rates (Source: Nielsen, 1993)

From figure 7.12, Nielsen (1993) suggest that three experts can identify 70% of the existing errors and cautions against using a larger number of experts as the benefits of doing so might not meet the costs. In the current study, three experts who have experience in technology adoption and usage in business settings have been selected. These experts were selected on the basis of their experience in the research domain area (Ghana) in order to obtain data relevant to the Ghanaian domain. The characteristics of the experts selected to review the final cloud computing adoption framework are presented in Table 7.9 below:

Table 47.9: Characteristics of Expert Reviewers (Source: Own Creation)

Expert Reviewer	Highest Level of Education	Years of Experience in Human-Computer Domain	Country	Cloud Computing Expert	Cloud Service User Experience
R1	Doctorate	18	Ghana	Expert	Intermediate
R2	Masters	13	Ghana	Expert	Expert
R3	Masters	10	Ghana	Expert	Intermediate

From the table, one expert has a doctorate degree while two have masters degrees. The expert's years of experience with computer systems ranged from 10 years to 18 years. All selected experts are experts in cloud computing while two are considered to have an intermediate level of expertise when it comes to the usage of cloud services in a corporate setting. One is however considered to be an expert in the usage of cloud services. All experts are based in Ghana and are familiar with the adoption factors of the local domain.

The final cloud computing adoption framework was presented to reviewers to analyse, comment and give suggestions on the applicability, usability and efficiency of the framework. The following information was sought from the experts:

1. Evaluation of the adoption benefits and drivers and their relevance in the framework.
2. Evaluation of the adoption concerns and barriers and their relevance in the framework.
3. Evaluation of the adoption interventions and the mapping of the appropriate concern or barrier.
4. Evaluation of information management practices and their relevance in the framework.
5. Expert's opinions on the framework as a whole.

7.8.2 Evaluation of Framework Components

To determine the applicability, usability and efficiency of the adoption framework, experts were tasked to evaluate the four components of the framework (concerns and barriers, benefits and drivers, information management practices, and adoption interventions). The evaluation can be considered a naturalistic evaluation because it include the performance of a solution within organizations (Venable, Pries-Heje, Baskervilles, 2012). They recommended two approachES to naturalistic evaluation: Ex ante and Ex post. Ex ante evaluation approach which according to Pries-Heje, Baskerville and Venable (2008) is an evaluation of uninstantiated artefact such as a design or model while Ex post is the evaluation of an instantiated artefact (i.e. an instantiation). These approaches can however be combined in a single evaluation. Naturalistic evaluation is empirical and may be interpretive and include surveys. The evaluation was done using scenarios. Scenarios entail constructing detailed scenarios around the artefact to demonstrate utility (Hevner, March, Park & Ram, 2004; Vaishnavi & Kuechler, 2007). Vaishnavi and Kuechler allowed the use of qualitative method. Therefore, using structure interviews (i.e. telephone interviews), experts were asked to evaluate the applicability, usability and efficiency of the framework. They were to do this through the execution of an assessment based on the adoption framework, of cloud application in a typical SME environment. Experts were asked to consider the applicability of the framework in design to see if it is implementable and whether its implementation can improve the effectiveness and efficiency of SMEs. They were also to evaluate the extent to which the processes and guidelines are clear and easy to use. Experts were then asked to reflect on the evaluation process and outcome and provide feedback.

Using the evaluation framework proposed by Pries-Heje (2008), a relevant evaluation strategy that was appropriate and also supported decision making about the evaluation method and are appropriate to achieve those strategies was adopted. As a guide, experts were asked to review the criteria (applicability, usability and efficiency) from the context of the following:

1. Evaluate an instantiation of the adoption framework to establish its utility and efficacy (or lack thereof) for achieving the stated purpose of adoption.
2. Evaluate the formalized knowledge about the adoption framework's utility for achieving its purpose.
3. Evaluate the adoption framework or formalized knowledge about it in comparison to other designed artefacts' ability to achieve a similar purpose.
4. Evaluate the adoption framework or formalized knowledge about it for side effects or undesirable consequences of using it.
5. Evaluate the adoption framework formatively to identify weaknesses and areas of improvement for the framework under development.
6. Evaluate the specific goals (rigor, efficiency and ethics) of evaluation design in DSR.

The above guidelines were combined into criteria that was considered as an input to the DSR evaluation design. These criteria were mapped to ex ante and ex post for a naturalistic evaluation method chosen for the review. This is depicted in table 7.10.

Table 7.10: DSR evaluation strategy and method selection framework for current study (source: Adapted from Vaneble et al.2012)

DSR Evaluation Strategy Selection Framework		**Ex Ante**	**Ex Post**
		Formative, Lower risk to participants (during the evaluation)	Evaluate instantiation
Naturalistic	Many diverse stakeholders, Socio-technical artefact, Artefact effectiveness, Desired Rigor: "Proof of the concept"	Experts, real problem, and unreal system, Low risk to participants	Best evaluation of effectiveness, Identification of side effect
DSR Evaluation Method Selection Framework			Survey

After deciding on the appropriate strategy to be used for the evaluation, the particular evaluation method is then chosen.

Vaneble et al. (2012) proposed four-step process for designing the evaluation components of a DSR project: (1) analyze the requirements for the evaluation to be designed, (2) map the requirements to one or more of the dimensions in the framework (see table 7.10), (3) select an appropriate evaluation method that align with the chosen strategy (see table 7.11), and (4) design the evaluation in more detail. Table 7.11 presents the guideline for the process of evaluation in relation to the four-step process listed above.

Table 7.11: Process for designing the evaluation for the study (Source: Adapted from Vaneble et al. 2012)

Objective	**Activities**
Analyze the context of the evaluation – the evaluation requirements	At this stage, experts were expected to identify, analyze, and priorities all requirements or goals for the evaluation.
Map the requirements to one or more of the dimensions	Experts were to matching the needed contextual factors (artefact) of the evaluation to the criteria in the DSR evaluation strategy selection framework (table 7.10)
Select an appropriate evaluation method or methods that align with the chosen strategy	Select appropriate evaluation method that align with the chosen strategy
Design the evaluation in more detail.	The DSR evaluation is design in detail. The ex ante evaluation precede ex post evaluation.

The next section discusses the recommendations received.

7.8.3 Feedback from Expert Reviewers

To determine the applicability, usability and efficiency of the adoption framework, experts were tasked to evaluate the framework using the most suited method of analysis, scenarios (i.e. construct detailed scenarios around the artefact to demonstrate utility). They were to do this through the execution of an assessment based on the adoption framework, of cloud application in a typical SME environment. Experts were asked to consider the applicability of the framework in design to see if it is implementable and whether its implementation can improve the effectiveness and efficiency of SMEs. They were also to evaluate the extent to which the processes and guidelines are clear and easy to use. Experts were then asked to reflect on the evaluation process and outcome and then send feedback.

From the comments made by the experts, the following were particularly significant in relation to the applicability, usability and efficiency of the framework:

1. The appropriateness of the framework for addressing cloud computing adoption within SMEs received a favourable response from the experts.

2. Experts indicated that knowledge of the adoption factors (adoption concerns and barriers, benefits and drivers, interventions and information practices) provides a good basis for adoption.

3. Experts cautioned the need for each adoption concern and barrier to be specifically mapped to the appropriate interventions. This is because one intervention can be applied to more than one concern. This was taken into consideration as indicated in figure 7.2.

4. It was suggested that the identification of adoption concerns and barriers is particularly important as this is the first step to conducting a risk assessment prior to adoption.

5. Experts felt that it was not clear how the framework should be used. This was taken into account and the guidelines were made clear and easy to apply.

6. Experts expressed the value of the adoption framework in the Ghanaian context and the need for continual review to accommodate new developments.

The overall evaluation process by experts and their feedback indicates that the final cloud computing adoption framework can effectively be applied by SMEs in the Accra-Tema metropolis of Ghana when adopting cloud computing. The next section discusses the completion stage of the evaluation phase.

7.8.4 Verification of the Final Cloud Computing Adoption Framework

Hevner recommends that "the utility, quality and efficiency of design artefact must be rigorously demonstrated via well-executed evaluation methods" (Hevner et al., 2004:279). Experts complained that it was not clear how the framework should be used. Table 7.10 summarizes typical design research evaluation methods used for evaluation as proposed by

Hevner et al. 2004 and Vaishnavi & Kuechler (2007). The design evaluation method most suited for this research project is scenarios (as highlighted in Table 7.12). Scenarios construct detailed scenarios around the artefact to demonstrate utility (Hevner et al., 2004; Vaishnavi & Kuechler, 2007).

Table 7.12: Design research evaluation methods (Source: Hevner et al., 2004; Vaishnavi & Kuechler, 2007)

Method	Description
Observational	**Case study**: Study artefacts in depth in business environment.
	Field study: Monitor the use of an artefact in multiple projects.
Analytical	**Static Analysis**: Examine the structures of an artefact for static qualities (e.g. complexity).
	Architecture analysis: Study the fit of an artefact into a technical IS architecture
	Optimisation: Demonstrate inherent optimal properties of an artefact or provide optimality bounds on artefact behaviour.
	Dynamic analysis: Study an artefact in use for dynamic quantities (e.g. performance).
Experimental	**Controlled experiment**: Study artefact in controlled environment for qualities (e.g. usability).
	Simulation: Execute an artefact with artificial data.
Testing	**Functional (black box) testing**: Execute artefact interfaces to discover failures and identify defects.
	Structural (white box) testing: Perform coverage testing of some metric (e.g. execution paths) in the artefact implementation.
Descriptive	**Informed argument**: Use information from the knowledge base (e.g. relevant research) to build a convincing argument for the artefacts' utility.
	Scenarios: Construct detailed scenarios around the artefact to demonstrate utility.

Hevner et al (2004) recommended the use of six criteria for the verification of IS artefacts and these were adapted in relation to the final cloud computing adoption frameworks. Table 7.13 indicates the criteria, their description in relation to the study and how each criteria was applied in this research study.

Table 7.13: Application of assessment criteria in the study (Source: Adapted from Hevner, 2004)

Criteria	Description in Relation to Study	Application to this Study
Applicability	Degree to which adoption information, procedures and guidelines are implementable .	The proposed cloud computing adoption framework was developed assessed in design to see if it is implementable and whether its implementation can improve the effectiveness and efficiency of SMEs. *Experts were of the opinion that the adoption factors, adoption assessment and evaluation guidelines were valuable as it provided a good basis for adoption.*
Efficiency	Degree to which adoption information, procedures and guidelines can be applied effectively.	The framework was assessed to evaluate the efficiency and usability. The identified interventions were evaluated

		for adequate design and implementation, which measures the effectiveness of the intervention and appropriateness of the implementation process. *Experts were of the view that the mapping of the interventions can be more user friendly if the descriptions of the interventions are provided. This considered and a thorough description of each intervention provided (see Table 7.5).*
Usability	Degree to which adoption information, procedures and guidelines are clear and easy to apply.	The cloud computing adoption information, mapping evaluation and assessment guidelines were clear and easy to apply during assessment. *Experts felt that it was not clear how the framework should be used. This was taken into account and the guidelines were made clear and easy to apply.*

The evaluation process will ensure that the adoption framework is effectively be implemented by SMEs to adopt cloud computing. After the evaluation of the framework by the experts, a final post-evaluation framework was developed. This is presented in figure 7.13 below.

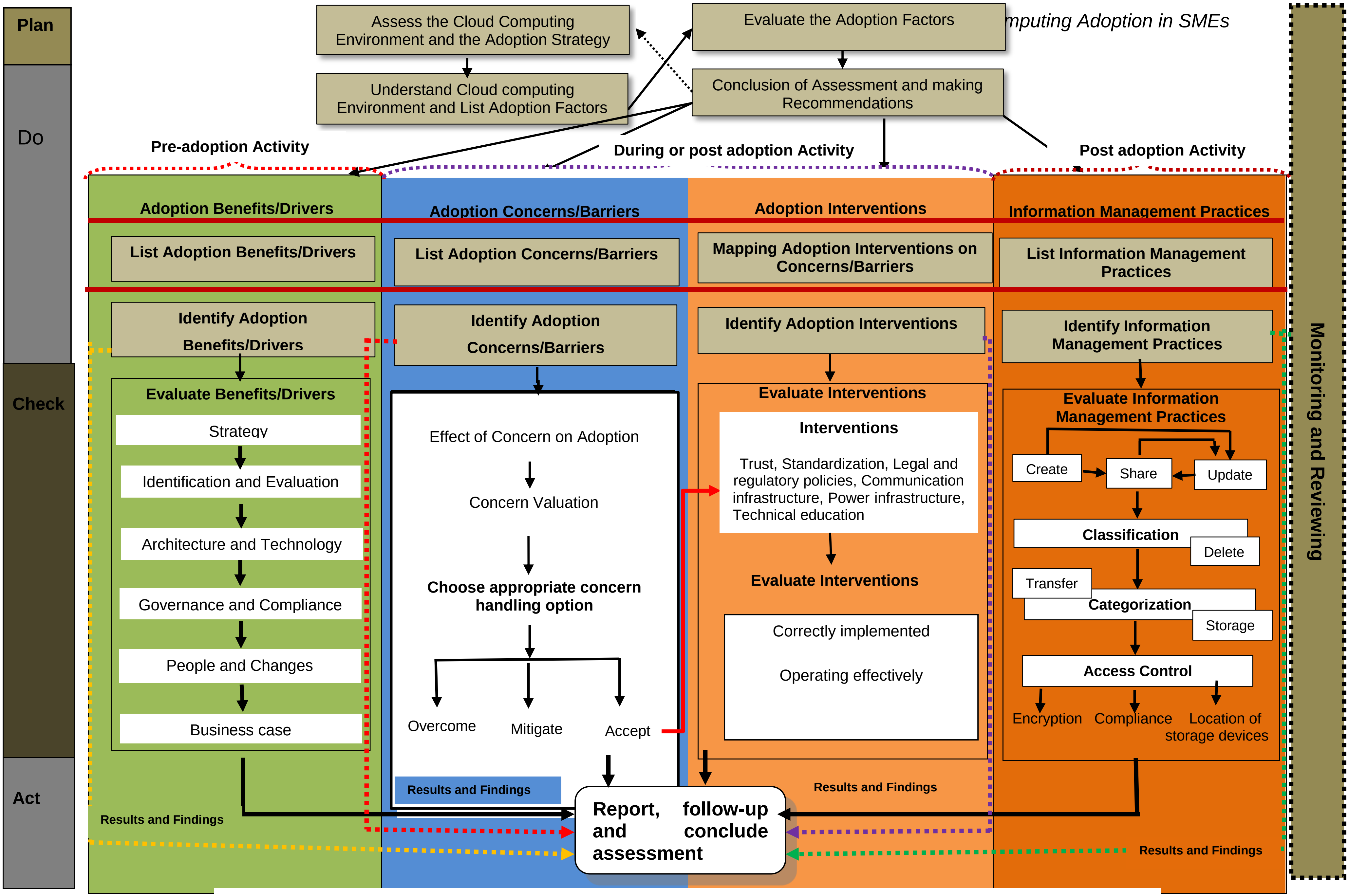


Figure 7.13: Final cloud computing adoption post-evaluation framework (Source: Own Creation)

7.9 Conclusion

This chapter gave an account of the research findings and how they were explored and integrated to produce an initial cloud computing adoption model by SMEs to enhance their competiveness. A detailed explanation of the four key components of the initial adoption model was provided. These four components are information management practices, adoption benefits and drivers, adoption concerns and barriers and adoption interventions. These components served as the reference point for the development of the proposed cloud computing adoption framework.

The study sought to formulate a framework for cloud computing adoption by SME in the Accra-Tema metropolis of Ghana. In order to fulfill this objective, the secondary objectives were investigated, namely:

1. To investigate the adoption of cloud computing to improve information practices for SMEs in the Accra-Tema metropolis of Ghana. Thus, a relationship between the classification and categorization of information shared in a collaborative, de-perimetrised environments was described in the framework.

2. To investigate factors of a framework to support cloud computing adoption by SMEs in the Accra-Tema metropolis of Ghana. Thus, factors that drive businesses to adopt cloud computing were included in the framework.

3. To investigate the stumbling blocks for SMEs when they decide to adopt cloud technology as a competitive tool. This objective was addressed through the inclusion of adoption concerns and barriers in the adoption framework.

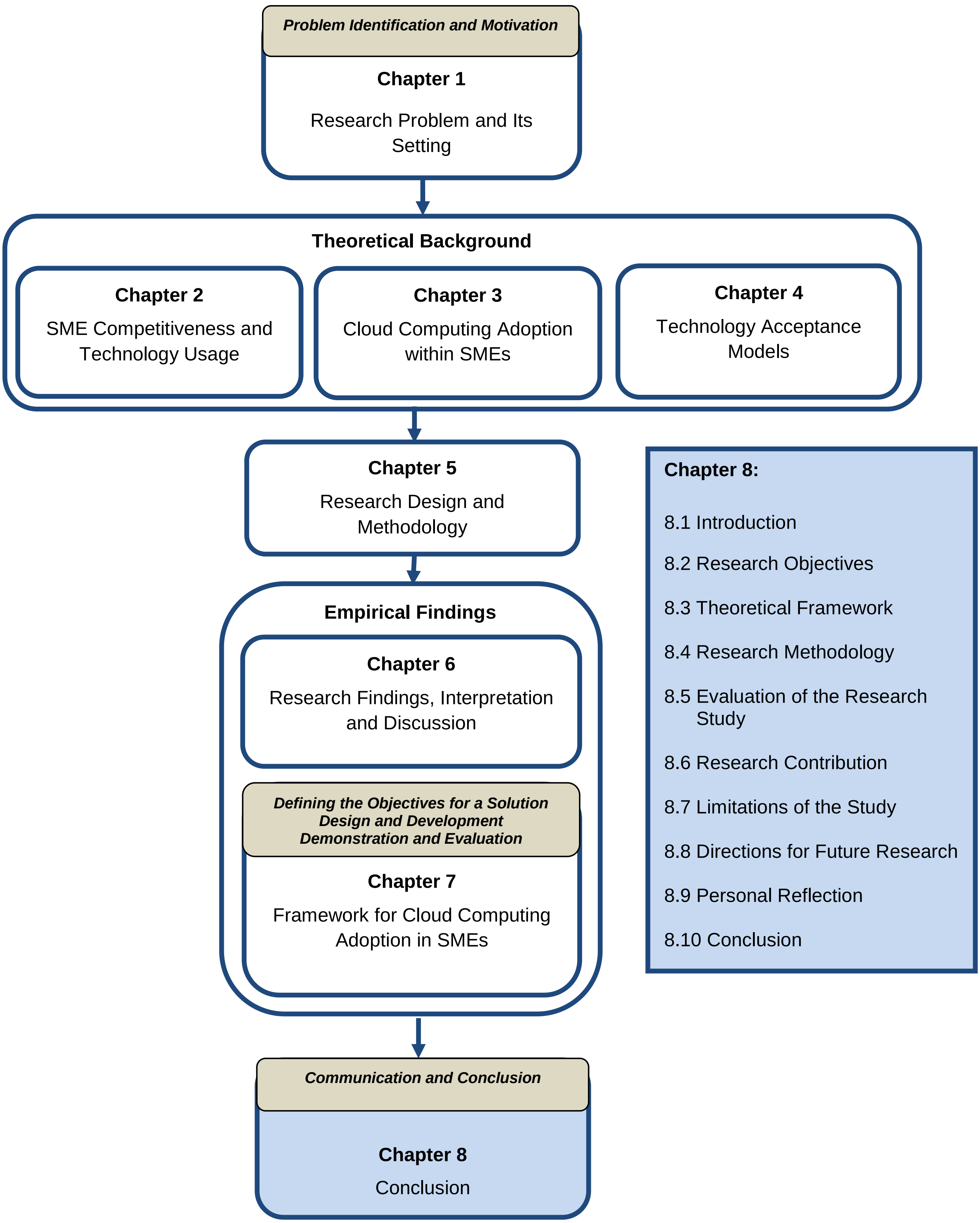
The framework was developed by:

1. Integrating the identified adoption factors (components) into a functional unit; and

2. Developing guidelines for assessing the cloud environment.

The integration was done by first establishing the stage of adoption where the identification and evaluation of the component is performed and then establishing interrelationships between the identified components. Then guidelines for assessing the cloud environment were developed. Finally, the proposed cloud computing adoption framework was presented. This framework was then evaluated through expert review.

The following chapter will provide a summative conclusion of the key aspects of this study. This concludes this research project by using the knowledge gained from the research to the research objectives for this study.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Chapter 2
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Chapter 8: Conclusion

8.1 Introduction

The previous chapter discussed the research findings and recommendations, the initial cloud computing adoption model and a proposed cloud computing adoption framework for small and medium-sized enterprises (SMEs). The findings were presented in response to the research question and sub-questions. An initial model was developed from the findings and refined to produce the adoption framework.

The framework presented in this study was based on secondary data collected from a review of relevant literature and from primary data obtained through web-based questionnaires and face-to-face interviews. The elements of the model and framework were further refined through the use of expert reviews, which satisfied the Design Science Methodology requirement that the research artefact be evaluated.

This chapter presents a brief summary and conclusion of the research project. The chapter begins by reviewing the research objectives, theoretical framework and the research methodology. An evaluation of the research study is then discussed. Finally, the research contributions, limitations and directions for future and a personal reflection are provided before the chapter is concluded.

8.2 Research Objectives

The research project investigated the following research question: *How can a framework assist SMEs in their adoption of cloud computing to make them more competitive in the Accra-Tema metropolis of Ghana?* Therefore, the primary objective of this research project was to formulate a framework for cloud computing adoption by SME in the Accra-Tema metropolis of Ghana. This was achieved in the proposed cloud computing adoption framework described in Chapter Seven.

The primary objective is addressed and the main research question answered through the following secondary research questions:

1. *How can the adoption of cloud computing improve information practices in small and medium-sized enterprises in the Accra-Tema metropolis of Ghana?*

This secondary research question was answered through the literature survey in Chapter Three. From the literature reviewed, a clear nature of cloud computing including the storage, transfer and the management of data was provided. A conclusion of the empirical findings relating to this secondary question are presented in table 8.1 below.

Table 8.1: Summary of findings for secondary research question 1 (Source: Own Creation)

Secondary Research Question	Conclusion of the Findings
Secondary Research Question 1	The conclusion drawn from the empirical findings shows that the use of cloud computing can improve information practices within SMEs to enhance their competiveness in the Accra-Tema metropolis and that the decision to adopt cloud services is influenced by issues associated with the management of information within a cloud environment. The issues are as a result of the fact that: 1. There is a perceived level of difficulty on the part of SMEs when it comes to the transfer of data over a cloud platform. This is mainly because, cloud computing allows for more storage capacity than on normal computer platforms and therefore includes risk of the fear that transferring data from the service provider's platform to their systems. 2. Although cloud computing is highly available and data can be accessed from anywhere, SMEs are not convinced about the procedures employed by cloud service providers in handling and processing their data. They will therefore prefer providers to make their data management procedures available. 3. Due to the sensitive nature of their work, SMEs attach great importance to their data. They are therefore conscious of the security measures service providers have put in place to protect their data whilst in their care. They also feel they own the data and need to have control over it at all times. They expect service providers to offer them some level of control.

2. *What are the factors of a framework to support the adoption of cloud computing by SMEs in the Accra-Tema metropolis of Ghana?*

This secondary research question was investigated through the literature survey in Chapter Three. From the literature survey it has shown that several factors positively impact on the decision to adopt cloud computing. Key among the factors noted included: virtual and on-demand, pay-as-you-go, agility, flexibility, elasticity, ease of implementation and use, cost reduction and multi-tenancy. The literature has shown that SMEs adopt cloud computing services to put them in a competitive position ahead of their competitors. From the empirical findings, aspects of these factors driving SMEs to adopt cloud computing were confirmed through the web-based questionnaire and the face-to-face interviews. The findings are presented in table 8.2 below.

Table 8.2: Summary of findings for secondary research question 2 (Source: Own Creation)

Secondary Research Question	Conclusion of the Findings
Secondary Research Question 2	The findings indicate that the adoption framework should discuss critical adoption variables that would address the various technical and social considerations that are necessary to create conditions conducive for encouraging the adoption of cloud computing by SMEs. Some of the factors that were discussed are:

	1. SMEs are familiar with cloud-based applications, even though just a few are using them currently. They are however willing to adopt cloud-based services depending on the availability of resources. The adoption is to serve specific business needs. In their use of the Internet, SMEs have encountered some level of security breach. This affects their decision to adopt Internet-based technologies like cloud computing. 2. The framework must include an adoption strategy, adoption considerations, adoption drivers and benefits of cloud computing. 3. For SMEs to better understand and identify how they can adopt cloud computing, they need an adoption strategy. The adoption strategy should include the adoption goal, adoption roadmap and adoption expectations. 4. Cloud computing is uniquely used by every SME and as such different adoption roadmaps exist for different SMEs. However, for the surveyed SMEs common elements that featured in their roadmaps are time frame for adoption, whether the functions of the services fit their business needs and the availability of resources to adopt and manage cloud services. 5. There is often a lack of consideration for the approach to adoption and the legal compliance requirement of the whole process. SMEs mentioned their approach to the cloud as either private, public or hybrid depending on the nature of their work and the availability of resources. They also acknowledge the fact that since cloud computing is offered as a service, there are legalities that must be understand before using the service. 6. Factors such as functionality, agility, innovative business environment, transformation of capital expenses to operational expenses, reduced information technology (IT) staff, minimal initial capital investment, efficiency, ease of work, increased productivity, easier accessibility of software and reduced system administration were found to motivate SMEs to move to the cloud. 7. SMEs expect cloud computing to play a stronger role to support strategic initiatives to grow their businesses and improve customer experience. The benefits of cloud computing have a positive influence on the decision to adopt. SMEs surveyed indicated that they adopt cloud computing to score economic benefits on hardware, software, maintenance, uptime and backups. Others adopt because cloud services are highly available, accessible and scalable.

3. *What inhibits small and medium-sized enterprises in adopting cloud technology as a competitive tool?*

This research objective was addressed in Chapters Two and Three. From the literature survey it has been noted that although cloud computing offers benefits to SMEs, its adoption is hampered by several factors. These are concerns that affect the decision to adopt cloud services. In addition, the literature has shown that there are considerable barriers to the adoption of cloud services. The findings of the empirical obtained from the questionnaire and interviews confirm these adoption concerns and barriers. The specific findings are presented in table 8.3 below.

Table 8.3: Summary of findings for secondary research question 3 (Source: Own Creation)

Secondary Research Question	**Conclusion of the Findings**
Secondary Research Question 3	The findings from both the questionnaire and interview indicate that, SMEs are inhibited from adopting cloud computing because of several concerns and barriers associated with the technology. Some of the findings indicated that: 1. SMEs feel that the hosting of resources on a third party infrastructure means that they will loss control over those resources to the service provider. 2. SMEs were concerned that cloud computing services may not integrate properly with their existing infrastructure and may not be compatible with their business applications. 3. For some SMEs, the evolving nature of cloud computing means the absence of fixed data privacy regulations but this varies between countries. Also the open nature of the Internet means data communicated over it is highly vulnerable to attacks. 4. SMEs indicated that they fear having their data locked-in on the platform of a provider should they decide to change from that particular service provider. 5. The perceived complexity of cloud computing was rejected by SMEs, who feel using cloud computing will help reduce the work of system administrators. 6. They expect their service providers to put validation controls in place to keep their data confidential. 7. SMEs surveyed expressed a concern that 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. They therefore perform regular data checks to ensure the integrity of their data. 8. SMEs indicated that Internet connectivity, initial start-up cost, lack of knowledge of cloud computing, power outages, uncertainty and low levels of awareness are some of the factors that concern them and hinder their adoption of cloud computing as a business strategy. According to some SMEs, cloud computing is still a new innovation and the level of awareness in the country is low. This has affected the rate of adoption and is a contributory factor to their late adoption. Most SMEs operate with a limited capital and have little money to invest in new technologies like cloud computing. They think initial start-up costs of adopting cloud services are a burden and a factor for late adoption. 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. 9. 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 barrier to adoption of cloud computing. 10. 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. Additionally, 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.

These concerns and barriers need to be resolved to ensure a successful adoption of cloud computing services.

Based on the literature survey, the empirical findings, and by following the Design Science Methodology, an initial cloud computing adoption model was produced. This was refined through expert reviews and to fulfill the primary objective of this research project, that is, the development of a cloud computing adoption framework.

8.3. Theoretical Framework

In order to develop the proposed framework for cloud computing adoption by SMEs in the Accra-Tema metropolis of Ghana to make them more competitive, two key frameworks were used, namely: Technology Acceptance Model (TAM) by Davis (1989), and Confidentiality, Integrity, Availability (CIA) Triad by Steichen (2010).

Davis (1989) proposed the TAM to specifically explain the determinants of technology adoption and usage. It sought to provide the effect of external factors on beliefs, attitudes and intentions. Davis (1989) proposed two variables, perceived usefulness and perceived ease of use, for explaining a user’s behavioural intention to adopt a technology. They serve as the starting point of the initial adoption model.

The CIA Triad is an industry-accepted model for guaranteeing security in systems to improve trust in using the system. It specifically explains the storage and management of data. The CIA Triad emphasises confidentiality, integrity and availability (Steichen, 2010).

8.4 Research Methodology

The study was conducted within a pragmatist paradigm, with influences from the Design Science approach. Also the interpretivist paradigm was employed as this was consistent with the qualitative research methodology adopted for the study. The Design Science methodology was used in this research project. The research project used the seven guidelines proposed by Hevner, March, Park and Ram (2004) for Design Science research. The seven guidelines were adopted in this research project as follows:

1. *Design as an Artefact:* The study explored how SMEs can achieve successful adoption of cloud computing. The final artefact is a framework that can assist SMEs to adopt cloud computing as a technology to make them more competitive.

2. *Problem Relevance:* The problem recognized in the study refers to the lack of competition amongst SMEs and how the use of cloud computing can make them more competitive.

3. *Design Evaluation:* The framework was evaluated by expert reviewers from technology and SME development domains. Their recommendations were incorporated into the final artefact.

4. *Research Contributions:* The design artefact, and framework, is expected to offer a valuable insight into how to use cloud computing technology appropriately in order to make SMEs more competitive.

5. *Research Rigor:* A questionnaire and interview guide was constructed based on themes derived from existing literature and questionnaires found in literature which have been validated previously. This facilitates reliability and efficiency. The proposed cloud adoption framework was assessed and validated using recommendations by expert reviewers.

6. *Design as a Search:* The research questions were answered using a combination of literature survey, existing theories, methodologies, and previous studies and primary data obtained from the empirical study. These methods was used to help legitimize the results of the study.

7. *Communication of Research:* The study satisfies this guideline by the publishing of research papers.

The study made use of a web-based questionnaire, interviews and expert reviews as primary data collection methods, and literature survey as secondary data collection. The process of data collection is presented in Figure 8.1.

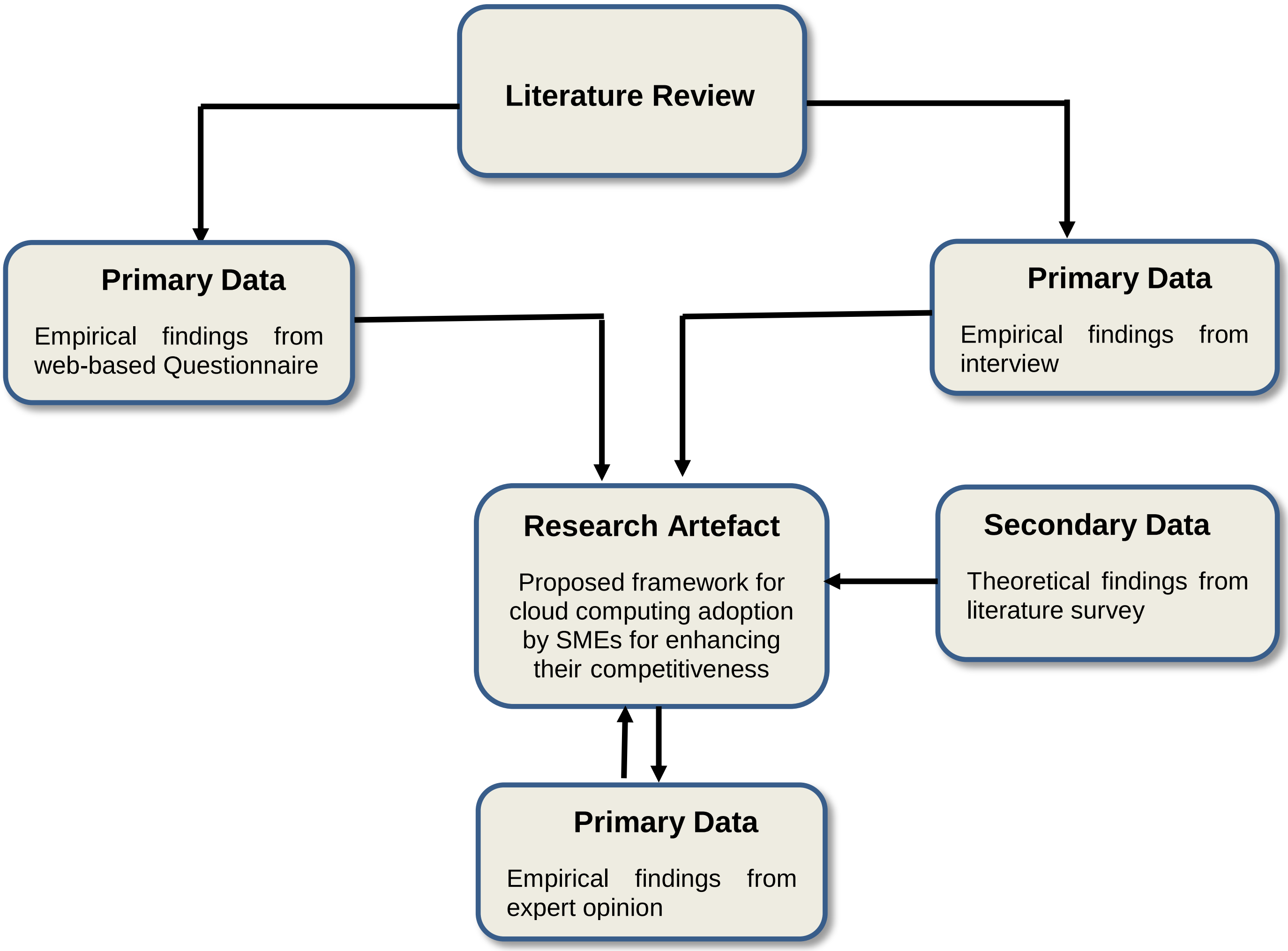

Figure 8.1: Data collection process for the study (Source: Own Creation)

From Figure 8.1, the literature survey formed the theoretical base for this study. The theoretical base impacted the development of the questionnaire and interview guide used to gather empirical data. These empirical findings, together with the secondary data, led to the development of an initial adoption model. This initial model was further refined to produce the research artefact (the framework for cloud computing adoption by SMEs in the Accra-Tema metropolis of Ghana). The proposed framework was then evaluated using the expert reviews.

8.5 Evaluation of the Research Study

The evaluation of a research study is done to establish credibility and trustworthiness. In the current study, the evaluation and validation was done to comply with the Design Science Methodology guidelines described in section 8.4. Since this study was partly grounded in the interpretivist paradigm, Oates's (2006) evaluation criteria for interpretivist research were adopted. These are described briefly below and explanation provided in terms of the applicability to this study:

1. *Credibility:* The use of multiple data collection instruments and expert reviews helped to bring about credibility in the study.

2. *Dependability:* Dependability has been achieved through the use of published literature and feedback from experts in the area of the study. The use of theories and models that have been used in other research over a period of time add dependability since they have been tested in previous studies. The theories and models used in this study are the Technology Acceptance Model proposed by Davis (1989) and CIA Triad by Steichen (2010).

3. *Trustworthiness:* The trustworthiness of the experts used to refine the proposed framework was evaluated. The experts used in this process are respected in the area of technology adoption and small business management. Thus, the recommendations made by these experts can be considered trustworthy.

4. *Conformability:* This study used questionnaire and interviews undertaken to confirm the theoretical findings. In addition, the inclusion of feedback from experts refined the proposed research framework.

5. *Transferability:* This study achieved transferability as the proposed framework can be applied to other users with similar settings, considering adopting and using a new technology.

These five criteria were applied and therefore the research study can be considered credible.

8.6 Research Contribution

The study sought to propose a conceptual framework that can assist SMEs in the Accra-Tema metropolis of Ghana to adopt cloud computing successfully. The study employed the use of the design science research process and focused on factors that affect the adoption of cloud computing services by SMEs. All the information gathered was aimed at answering the research questions. The whole process led to the practical and methodological contributions described in the following sub-sections.

8.6.1 Practical Contribution

A cloud computing adoption framework which can assist SMEs in the Accra-Tema metropolis of Ghana was developed in this study. Factors that affect the decision to adopt cloud computing were investigated and their effect on the decision noted. The findings show that factors such as knowledge of the adoption benefits which drive SMEs to adopt and use cloud computing is necessary. However, adoption concerns and barriers negatively affect the decision to adopt. SMEs will only adopt when certain interventions are applied to tackle individual concerns and barriers. The management of information in the cloud was also found to be a deciding factor.

In Ghana, available research on cloud computing does not provide clear guidelines for ensuring a successful adoption process and continued use. This study thus set out to develop a framework to assist SMEs to adopt and use cloud computing. The framework developed and discussed in Chapter Seven is the main contribution of this research study. The framework was developed to give oversight through structures and guidelines to allow for a successful cloud computing adoption.

The specific practical contribution made through the development of this framework was the proposal of a comprehensive list of steps for the planning, evaluating and reporting on cloud computing benefits and drivers, concerns and barriers, interventions and the management of information. Thus, the framework was developed to allow for the integration with existing IT infrastructure and to ensure adoption and widespread use of cloud computing services.

8.6.2 Theoretical Contribution

According to Holweg and Donk (2009), conceptual frameworks can considered as theoretical contributions when they are elaborate, theory-driven, descriptive and contributory. Such a framework must have variables and established relationships among these variables. Miles and Huberman (2005) further added that these variables and relationships should be tied to the answering of the research questions.

Thus, the cloud computing adoption framework proposed in this study can be regarded as the main theoretical contribution. In this study, the empirical findings show that four variables affect the decision by SMEs in the Accra-Tema metropolis to adopt and use cloud computing. Details of these variables were discussed in chapter 3 and the relationships between these variables provided in chapter 7 of the study. These variables and relationships serve as the main components of the proposed cloud computing adoption framework.

In addition, Locke and Golden-Biddle (1997) added that theoretical contributions should be seen as ideas assessed by the scholarly community and confirmed by relevant sources. In the current study, components of the proposed adoption framework were obtained from the empirical findings, and therefore can be said to be empirically tested. The framework was further reviewed by experts from the research domain, namely Ghana. The study can therefore be said to have made a theoretical contribution to the body of knowledge.

8.7 Limitations of the Study

Although the study provided insight into factors impacting the decision to adopt cloud computing, some limitations must be addressed and acknowledged. These limitations can provide direction for future research.

This study addresses the low response by SMEs to the adoption of cloud computing in their operations. A specific focus of the research was on the adoption decision and not how cloud computing is implemented in SMEs. A study on the effect of implementation factors is recommended for better understanding of the cloud computing implementation stage. For this study, to accept or obtain something (cloud computing) stands for adoption while using that something (cloud computing) following steps is implementation. This limitation of the study is acknowledged and also provides a direction for future research as described below.

Additionally, the study focused solely on SMEs in the Accra-Tema metropolis of the Greater Accra region of Ghana and this does not allow for the generalization of the empirical results since the level of infrastructural development can vary from place to place. Future research needs to cover other regions of the country and similar developing contexts.

8.8 Directions for Future Research

Further research can be undertaken to investigate the effect of cloud computing implementation factors for a better understanding of the different stages of cloud implementation. In addition, other researchers can investigate cloud computing adoption decision factors in other regions of Ghana. Although the guidelines developed as part of the framework formulation were empirically tested (and therefore developed from the empirical results) and validated by experts, its testing can be practically done in a further study.

8.9 Personal Reflection

The need to carry out this study was necessitated by the inability of small businesses in Ghana to compete equally on the local, regional and international markets with their larger counterparts. As a native of Ghana and with a strong academic will to think and improve systems and processes, I decided to carry out this study to develop something that can help balance small and larger businesses.

Having started my IT career with a small local software development company in the study area, I was aware of the gap that existed between small and larger enterprises in terms of the ability to adopt and use new technologies. Small businesses were not up to pace with their larger counterparts in terms of the adoption and usage of new technologies. The study was therefore carried out from this context, in order to develop a cloud computing adoption framework with a comprehensive outline of how to plan, evaluate and report on cloud computing benefits and drivers, concerns and barriers, interventions and the management of information.

8.10 Conclusion

SMEs are faced with numerous challenges and this results in them being unable to compete equally with their larger counterparts. As presented in chapter two of this study, SMEs contribute massively to the socio-economic development of any country regardless of the challenges that they are faced with. Attention must therefore be given to SMEs by identifying ways to help them stay more competitive.

The adoption and continued use of cloud computing is reported to be a major avenue that SMEs could exploit to help them a competitive tool. It should however be noted that, for any meaningful gain to be realized from using cloud computing, the adoption process should be critically considered to ensure a successful adoption that will lead to its continued use. It is within these grounds that this study focused on producing a framework to assist SMEs to adopt cloud computing in the Accra-Tema metropolis of Ghana.

This study proposed a cloud computing adoption framework that gives a comprehensive outline of how to plan, evaluate and report on cloud computing benefits and drivers, concerns and barriers, interventions and the management of information. The proposed framework will help to ensure that SMEs adopt and effectively use cloud computing solutions as a competitive tool.

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Appendices

A Ethical Clearance Certificate

B Research Instrument: Cloud Computing Adoption Questionnaire

C Research Instrument: Cloud Computing Adoption Interview Questions

D Measuring Adapted Technology Acceptance Model and CIA Triad Constructs on Questionnaire and Interview guide

E Informed Consent

Appendix A: Ethical Clearance Certificate

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: PID031SADA01

Project title:	**Towards a framework for cloud technology adoption in SMEs : A case of Accra-Tema Metropolis of Ghana**
Nature of Project:	PhD
Principal Researcher:	Martin Adane
Supervisor:	Dr R Piderit
Co-supervisor:	

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commerce with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principal or practices are revealed or suspected
  - Relevant information has been withheld or misrepresented
  - Regulatory changes of whatsoever nature so require
  - The conditions contained in the Certificate have not been adhered to
- Request access to any information or data at any time during the course or after completion of the project.
- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office

3.

4. The Ethics Committee wished you well in your research.

5.

6. Yours sincerely,

Professor Gideon de Wet
Dean of Research

23 March 2015

7.

8.

9.

10.

11.

12.

13.

Appendix B: Cloud Computing Adoption Questionnaire

14.

Section A: Demographic Characteristics of Respondents

1**.** Please indicate your gender

- Male
- Female

2. Please indicate your highest level of education

- High School
- Certificate
- Diploma
- Professional
- Bachelor’s Degree
- Postgraduate Degree

Section B: Background Characteristics of SMEs

3. What is the size of your company?

    - 1-5 Employees (micro)
    - 6-29 Employees (small)
    - 30-99 Employees (medium)

4. Years since establishment:

        - Less than a year
        - 1-5 years
        - More than 5 years

5. In which industry does your firm operate?

- Technology Education Financial services
- Service Energy Legal & professional services
- Manufacturing Healthcare Other (please specify)

6. What is the market scope for your company?

- Local
- Regional
- National
- International

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

- We have already adopted some cloud services
- We intend to adopt cloud services in the next 6 months
- We don't intend to adopt any cloud services for the foreseeable future

15.

Section C: Internet Experience

1. In what way has Internet been adopted in your firm.

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

   Yes

   No

3. In your view, how serious is the threat of intruders or hackers gaining access to businesses' online information?

16.

Major threat	
Moderate threat	
Minor threat	
Minor threat	

17.

Section D: Current Use of and Familiarity with Cloud-Based Applications (Indicate with an X)

Application	**Currently Use**	**Familiar With but not currently using**	**Currently Use or Were Familiar With**
Google Apps			
Facebook			
Gmail			
Skype			
Yahoo mail			
LinkedIn			
Twitter			
PayPal			
Hotmail			
Flickr			
Microsoft Office 365			
Dropbox			
Microsoft Security Essentials			
Other (please specify)			

Section E: Cloud Experience

1. Firm willing to use /adopt cloud computing for (parts of) your IT?

   Yes/No

2. Why does your firm use (or not) use cloud computing services?

3. How have cloud services affected the processes in your company?

4. What aspects of cloud computing should be improved?

5. Does your firm plan to invest in cloud computing in short, medium or long term?

Short term ((Within next 6 months)

Medium term (within 7-12 months)

Long term (more than 12 months)

Unsure

6. Do you have any formal training in technology usage or related areas?

21.

22.

Section F

Scales:

5. Strongly Agree

4. Agree

3. Uncertain

2. Disagree

1. Strongly Disagree

Statements		Response				
	Adoption	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly Agree**
1	Firm willing to use/adopt cloud computing for (parts of) your IT?	1	2	3	4	5
2	We have resources, but just haven't had the time to implement cloud computing	1	2	3	4	5
3	We don't have the resources to get people trained to use cloud computing	1	2	3	4	5
4	We don't have resources to implement new technologies and applications	1	2	3	4	5
	Concerns					
5	There is the loss of control of information to the cloud service provider	1	2	3	4	5
6	We rely solely on the cloud service provider to offer secure authentication, user credentials and role management	1	2	3	4	5
7	Cloud computing services might not function properly and create problems with our overall IT operations	1	2	3	4	5
8	Cloud computing service servers may not function	1	2	3	4	5

	well and may not support our IT operations to our expectations					
9	Using cloud computing services running from outside the country would lead to a loss of privacy for us, because of differences in privacy rules in both countries	1	2	3	4	5
10	Because of differences in legislation, we might lose control of our data if we want to change the service provider hosting data.	1	2	3	4	5
11	It is believed that the use of cloud computing services to do our work will be achieved with ease	1	2	3	4	5
12	It is easy for me to learn how to administer cloud computing services.	1	2	3	4	5
13	security concerns are a blocking issue when it comes to cloud computing	1	2	3	4	5
	Drivers					
14	Decisions on moving to cloud are about functionality, not about cloud vs. non-cloud	1	2	3	4	5
15	Cloud implementation is more expensive, but agility is worth it	1	2	3	4	5
16	Cloud computing offer a more agile and innovative business environment	1	2	3	4	5
17	Cloud computing transforms capital expenses to operating expenses	1	2	3	4	5
18	Using cloud computing services requires fewer IT staff	1	2	3	4	5
19	Using cloud computing services requires low capital investment	1	2	3	4	5
20	The use of cloud computing services allow us to have more work done quickly.	1	2	3	4	5
21	The use of cloud computing services gives superior control over our work	1	2	3	4	5

22	The use of cloud computing services increases our productivity.	1	2	3	4	5
23	Cloud computing services allow for easier software access	1	2	3	4	5
24	Cloud computing services reduces system administration	1	2	3	4	5
25	There is easier software access when using cloud computing services	1	2	3	4	5
	Information Management Issues					
26	It is difficult to move large amount of information through the cloud	1	2	3	4	5
27	Cloud computing service offer more storage space than on computers	1	2	3	4	5
28	Cloud computing services makes it possible to access data wherever you are	1	2	3	4	5
29	Cloud providers must offer certification summaries on their data processing and data security activities and the data controls they have in place	1	2	3	4	5
30	Cloud providers must provide information on their data handling practices.	1	2	3	4	5
31	latency of data transfer to the cloud is acceptable	1	2	3	4	5
32	Cloud providers must provide outline of their data security activities	1	2	3	4	5
33	Data control techniques used by service providers must be available to clients	1	2	3	4	5

Appendix C: Cloud Computing Adoption Interview Guide

Introduction

I appreciate the opportunity granted me to interview you and for taking the time for me to meet with you today. The purpose of this interview is to gain an insight into the adoption of cloud computing for cloud computing by SMEs to make them competitive in Ghana.

The list of questions is a guide to the type of issues that the study is trying to investigate. The questions are therefore sent in advance so that you can prepare and also familiarize yourself with some of the terms used in the study.

All responses will be kept confidential. This means that your interview responses will not be made public. To analyze the transcript for this study, I will obscure any information that cloud identify you or your firm by coding. This will allow me to analyze the transcript and produce results without bias.

Demographic Information

1. How many years has this firm been operating?
    - Less than a year
    - 1-5 years
    - More than 5 years
2. How many people are employed in each of the following areas of your business?

    23.

    24. Entire firm

    - <5 (micro) 6-29 (small) 30-99 (medium)

    Within your department

    - <5 6-29 30-99

    25.
3. What is your firm's primary business activity? (Select one only)

- Education
- Computer related
- Business services/Consultant
- Wholesale/Retail/Distribution
- Manufacturing and Process
- Banking/Finance/Accounting
- Marketing/ Advertising/Entertainment
- Others (specify)

4. What is the main product or service of your firm?

5. What was your firm's total gross sales volume for last year?

- <$10,000
- $10,000-$100,000
- $100,000-$1000,000
- Over $1000,000

26.

6. What is your current educational level?

A postgraduate degree	
A bachelor's degree	
Diploma	
Certificate	
High School level	
Other (please specify)	

7. What is your job function?

- Business Management
- IT Management
- Professional/others

8. How many departments exist in your firm?
9. Who are your primary client?

Enterprise Cloud Strategy

1. What does cloud computing mean for your business and plan to establish from cloud?
2. What is your firm's cloud adoption roadmap? Main elements of roadmap are time, functions, business applications, resources.

Cloud Computing Adoption

1. Where is your firm today in cloud adoption? Are you completely new to cloud computing, Data Center, or completely knowledgeable in cloud?

   27.

2. What does your firm hope to achieve, and plan to establish from cloud?

   28.

3. What approach to cloud computing is your firm taking (Public cloud, private cloud, hybrid cloud) and what resources is your firm utilizing to realize the adoption goals?

   29.

4. Has your firm adopted or considers adopting any cloud computing services from those listed below?

   (i) Individual software packages

   (ii) Infrastructure services such as storage, network capacity, etc.

   (iii) A complete operating system and software package available via cloud services

(iv) Security services in the cloud

(v) N/A

(vi) Other (please specify)

30.

5. If you have adopted any cloud computing service, for how long have you been using this service?

31.

6. Cloud solutions are complex and consist of the use of many different applications, tools and services, all coming with differing licensing models and processes. Does your firm have any understanding of the complexity of the whole process?

7. Cloud solutions are complex and therefore there is the need for layers of legal agreements to be in place. Does your firm understand all the legal layers and is able to create and manage all legal contracts consequently?

32.

8. What factors, from your firm's perspective, are key to cloud computing adoption? Control, Uncertainty, Cost, Privacy, Agility, Functionality.

33.

34.

9. What best practices has your firm identified as part of the cloud computing adoption?

35.

10. How does your firm comply with regulations as it moves to cloud?

36.

37.

11. Does the cloud computing service fit well with your business beliefs and practices?

38.

Drivers

1. How can each of the following motivate your organization to move your IT to cloud services?

    (i) Cost

    (ii) Ease of setup

    (iii) Agility

    (iv) Ease of use and Administration

    (v) Relative Advantage

    39.

2. What benefits do you expect from cloud computing?

Concerns

1. What are your main concerns when it comes to the use of cloud computing?

    (i) Control

    (ii) Uncertainty

    (iii) Cost

    (iv) Privacy

    (v) Security

    (vi) Confidentiality

    (vii) Integrity

    (viii) Availability

    (ix) Other (please specify)

    40.

2. How is your firm governing its move to cloud? Elements of governance are structure, personnel, processes, tools.

    41.

3. What type of knowledge/expertise is lacking/insufficient within your organization regarding cloud computing?

   42.

4. What risks has your firm identified after adopting cloud?

   43.

5. What are your firm's mitigation plans?

   44.

   45.

6. What negative effects to your firm can you associate with the usage of cloud computing?

   46.

7. What do you see as the main barriers to the adoption of other cloud computing services in your firm?

Cost and Benefit Realization

1. Did your firm see a surge in costs during its movement to cloud computing?

   47.

2. What benefits do you actually expect from moving to cloud computing?

3. What is the cost saving distribution across compute and other environments?

   48.

4. What advantages and performance improvements does your firm want to achieve by moving to the cloud? Has your firm quantified benefits of moving to cloud? If yes, what are those benefits?

   49.

   50.

   51.

   52.

53.

54.

55.

56.

57.

58.

59.

60.

61.

Appendix D: Measuring Adapted Technology Acceptance Model and CIA Triad Constructs on Questionnaire and Interview

Questionnaire and Interview – Section A & B

Questionnaire – Demographic and Background Characteristics Information
Please indicate your gender • Male • Female Please indicate your highest level of education • High School • Certificate • Diploma • Professional • Bachelor's Degree • Postgraduate Degree **Background Characteristics of SMEs** What is the size of your company? • 1-5 Employees (micro) • 6-29 Employees (small) • 30-99 Employees (medium) Years since establishment: • Less than a year • 1-5 years • More than 5 years In which industry does your firm operate? • Technology Education Financial services • Service Energy Legal & professional services • Manufacturing Healthcare Other (please specify) What is the market scope for your company? • Local • Regional • National • International

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

- We have already adopted some cloud services
- We intend to adopt cloud services in the next 6 months
- We don't intend to adopt any cloud services for the foreseeable future

Interview Guide – Demographic Information

62. How many years has this firm been operating?
    - Less than a year
    - 1-5 years
    - More than 5 years
63. How many people are employed in each of the following areas of your business?
64. Entire firm
    - <5 (micro)   6-29 (small)   30-99 (medium)

Within your department

- <5   6-29   30-99

65.
66. What is your firm's primary business activity? (Select one only)
    - Education
    - Computer related
    - Business services/Consultant
    - Wholesale/Retail/Distribution
    - Manufacturing and Process
    - Banking/Finance/Accounting
    - Marketing/ Advertising/Entertainment
    - Others (specify)
67. What is the main product or service of your firm?

68. What was your firm's total gross sales volume for last year?
    - <$10,000
    - $10,000-$100,000
    - $100,000-$1000,000
    - Over $1000,000
69.
70. What is your current educational level?

A postgraduate degree	
A bachelor's degree	
Diploma	

Certificate	
High School level	
Other (please specify)	

71. What is your job function?
    - Business Management
    - IT Management
    - Professional/others
72. How many departments exist in your firm?
73. Who are your primary client?

Questionnaire

Section I – Perceived Usefulness (PU)	
Cloud computing service servers may not function well and may not support our IT operations to our expectations	PU1
security concerns are a blocking issue when it comes to cloud computing	PU2
Cloud implementation is more expensive, but agility is worth it	PU3
Cloud computing offer a more agile and innovative business environment	PU4
Cloud computing transforms capital expenses to operating expenses	PU5
Using cloud computing services requires low capital investment	PU6
The use of cloud computing services allow us to have more work done quickly.	PU7
The use of cloud computing services gives superior control over our work	PU8
The use of cloud computing services increases our productivity.	PU9
Cloud computing services allow for easier software access	PU10
Cloud computing services reduces system administration	PU11
There is easier software access when using cloud computing services	PU12
It is difficult to move large amount of information through the cloud	PU13
Cloud computing service offer more storage space than on computers	PU14
Section II – Perceived Ease of Use (PEU)	
Why does your firm use (or not) use cloud computing services?	PEU1
74. In what way has Internet been adopted in your firm.	PEU2
What aspects of cloud computing should be improved?	PEU3

Do you have any formal training in technology usage or related areas?	PEU4
We have resources, but just haven't had the time to implement cloud computing	PEU5
We don't have the resources to get people trained to use cloud computing	PEU67
We don't have resources to implement new technologies and applications	PEU8
Cloud computing services might not function properly and create problems with our overall IT operations	PEU9
It is believed that the use of cloud computing services to do our work will be achieved with ease	PEU10
It is easy for me to learn how to administer cloud computing services.	PEU11
Decisions on moving to cloud are about functionality, not about cloud vs. non-cloud	PEU12
Using cloud computing services requires fewer IT staff	PEU13
Section III – Behavioural Intention to Use (BIU)	
Firm willing to use /adopt cloud computing for (parts of) your IT?	BIU1
Does your firm plan to invest in cloud computing in short, medium or long term?	BIU2
Section IV – Attitude Towards Use (ATU)	
How have cloud services affected the processes in your company?	ATU1
We rely solely on the cloud service provider to offer secure authentication, user credentials and role management	ATU2
75. Has your organization ever experienced an Internet security breach that affected business operations?	ATU3
76. In your view, how serious is the threat of intruders or hackers gaining access to businesses' online information?	ATU4
Current Use of and Familiarity with Cloud-Based Applications	ATU5
Section V – Perceived Trustworthiness (PT)	
Using cloud computing services running from outside the country would lead to a loss of privacy for us, because of differences in privacy rules in both countries	PT1
latency of data transfer to the cloud is acceptable	PT2
There is the loss of control of information to the cloud service provider	PT3
Section VI – Confidentiality (CO)	
Because of differences in legislation, we might lose control of our data if we want to change the service provider hosting data.	CO1
Cloud providers must offer certification summaries on their data processing and data security activities and the data controls they have in place	CO2

Cloud providers must provide information on their data handling practices.	CO3
Cloud providers must provide outline of their data security activities	CO4
Data control techniques used by service providers must be available to clients	CO5
Section VII – Availability (AV)	
Cloud computing services makes it possible to access data wherever you are	AV1

Interview Guide

Section I – Perceived Usefulness (PU)	
77. How can each of the following motivate your organization to move your IT to cloud services?	PU1
78. What benefits do you expect from cloud computing?	PU2
79. What are your main concerns when it comes to the use of cloud computing?	PU3
80. What benefits do you actually expect from moving to cloud computing?	PU4
What is the cost saving distribution across compute and other environments?	PU5
81. What advantages and performance improvements does your firm want to achieve by moving to the cloud? Has your firm quantified benefits of moving to cloud? If yes, what are those benefits?	PU6
82. What type of knowledge/expertise is lacking/insufficient within your organization regarding cloud computing?	PU7
83. What factors, from your firm's perspective, are key to cloud computing adoption? Control, Uncertainty, Cost, Privacy, Agility, Functionality.	PU8
84. What do you see as the main barriers to the adoption of other cloud computing services in your firm?	PU9
Section II – Behavioural Intention to Use	
85. What does cloud computing mean for your business and plan to establish from cloud?	BIU1
86. What is your firm's cloud adoption roadmap? Main elements of roadmap are time, functions, business applications, resources.	BIU2
87. What does your firm hope to achieve, and plan to establish from cloud?	BIU3
88. What approach to cloud computing is your firm taking (Public cloud, private cloud, hybrid cloud) and what resources is your firm utilizing to realize the adoption goals?	BIU4

89. Has your firm adopted or considers adopting any cloud computing services from those listed below?	BIU5
Cloud solutions are complex and consist of the use of many different applications, tools and services, all coming with differing licensing models and processes. Does your firm have any understanding of the complexity of the whole process?	BIU6
90. Cloud solutions are complex and therefore there is the need for layers of legal agreements to be in place. Does your firm understand all the legal layers and is able to create and manage all legal contracts consequently?	BIU7
91. How is your firm governing its move to cloud? Elements of governance are structure, personnel, processes, tools.	BIU8
92. What best practices has your firm identified as part of the cloud computing adoption?	BIU9
What are your firm's mitigation plans?	BIU10
Section III – Attitude Towards Use (ATU)	
93. Where is your firm today in cloud adoption? Are you completely new to cloud computing, Data Center, or completely knowledgeable in cloud?	ATU1
94. If you have adopted any cloud computing service, for how long have you been using this service?	ATU2
95. How does your firm comply with regulations as it moves to cloud?	ATU3
96. Does the cloud computing service fit well with your business beliefs and practices?	ATU4
97. What negative effects to your firm can you associate with the usage of cloud computing?	ATU5
98. Did your firm see a surge in costs during its movement to cloud computing?	ATU6
99. What risks has your firm identified after adopting cloud?	ATU7

Appendix E: Informed Consent

INFORMED CONSENT

I hereby agree to participate in research regarding the use of cloud computing in SMEs in Ghana. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my community on the results of the completed research.

…………………………….. ....

Signature of participant **Date**

I hereby agree to the tape recording of my participation in the study

…………………………….. ....

Signature of Participant **Date**

References

Et al

Accronyms

Toc, figures etc111