

ROLE OF CLOUD COMPUTING AS TECHNOLOGY INNOVATION IN SMALL AND MEDIUM ENTERPRISES IN SOUTH AFRICA

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Abstract

The paper discusses cloud computing as a technology innovation for small and medium enterprises (SMEs) in South Africa to improve competitiveness, retain sustainability and maintain cost-effectively. The concept of duality of structures (DoS) of Giddens' Structuration Theory was used as a lens through which to understand and interpret the factors influencing the readiness of SMEs to adopt cloud computing as a lens to innovate their businesses and become competitive in the face of global economic slowdown, high cost of IT services and inadequate e-competency. The purpose of the study was to determine the readiness of SMEs to innovate their businesses using technology solutions such as cloud computing. An extensive investigation on sixteen (16) SMEs from Gauteng and Mpumalang Provinces indicated a number of factors suggested by DoS have influenced the readiness of SMEs to adopt technology. The perspective is that clouding computing adoption as a technology innovation suggests a significant trend with the potential to increase agility and lower costs of IT services. The finding of the study is a general framework to guide SMEs to assess their readiness to adopting these technologies to save costs, improve their efficiency and competitive position.

Keywords: Structuration Theory, Cloud Computing, Innovation, Technology, Readiness, Small Medium Enterprises (SMEs)

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1 Introduction

The objective of this paper is to determine the readiness of Small and Medium Enterprises (SMEs) in South Africa to adopt cloud computing as technology innovation to meet their strategic business objectives. The question therefore was: what are the factors influencing technological innovation readiness of SMEs and how can cloud computing benefit SMEs towards meeting their business objectives? The paper discusses the factors influencing the readiness of SMEs in adopting technology such as cloud computing to innovate their businesses. Innovation of business using technology most often leads to advantage in competition due to for example cost leadership. The research used a social theory, particularly, the concept of duality of structures (DoS) of Structuration Theory (ST) as a lens (see section 2 below) through which to understand and interpret the degree of readiness of SMEs to adopt cloud computing as a technology innovation to be competitive. The paper further discusses how the use of innovative technologies such as cloud computing

enables SMEs to save costs, improve their efficiency and be at a competitive position. The discussions are based on data collected from six (6) SMEs from Gauteng and Mpumalanga Provinces that show a good representation of SMEs in dynamic and non-dynamic socio-economic regions in South Africa. SMEs are without a doubt regarded as the most critical element of any developing economy such as South Africa. The new technologies for innovation can function as drivers in such developing economies to increase SMEs' efficiency to compete well in the current global economy; yet according to Cruz-Cunha and Varajão (2010) majority of the SMEs view information and communication technology (ICT) costs in particular as their main hindrance towards investing in it. SMEs usually have limited resources required to drive ICT (op. cit.). According to Karkkainen and Ala-Risku (2003), some of the main IT costs affecting SMEs are, capital expenditure (Capex) relating to hardware costs as they generally have limited access to capital required to invest in IT hardware and software. Furthermore, IT labour costs to support traditional approaches such as using in-

house IT infrastructure and software licensing costs was identified by Karkkainen and Ala-Risku (2003) as a challenge for SMEs to adopt technology innovation. None of these researchers Cruz-Cunha and Varajão (2010) and Karkkainen and Ala-Risku (2003) actually looked at the readiness of SMEs to adopt technology for innovation. Furthermore, unlike the large enterprises, SMEs cannot afford big ICT investments and as such would require affordable ICT solutions that are designed and tailored to meet their business strategic objectives. SMEs need solutions which would not require them to acquire their own IT infrastructure and therefore would not need expensive capital investment for IT infrastructure. This paper presents a theoretical perceptive and interprets the phenomenon with data from a real case study. The paper also suggests a general framework that will

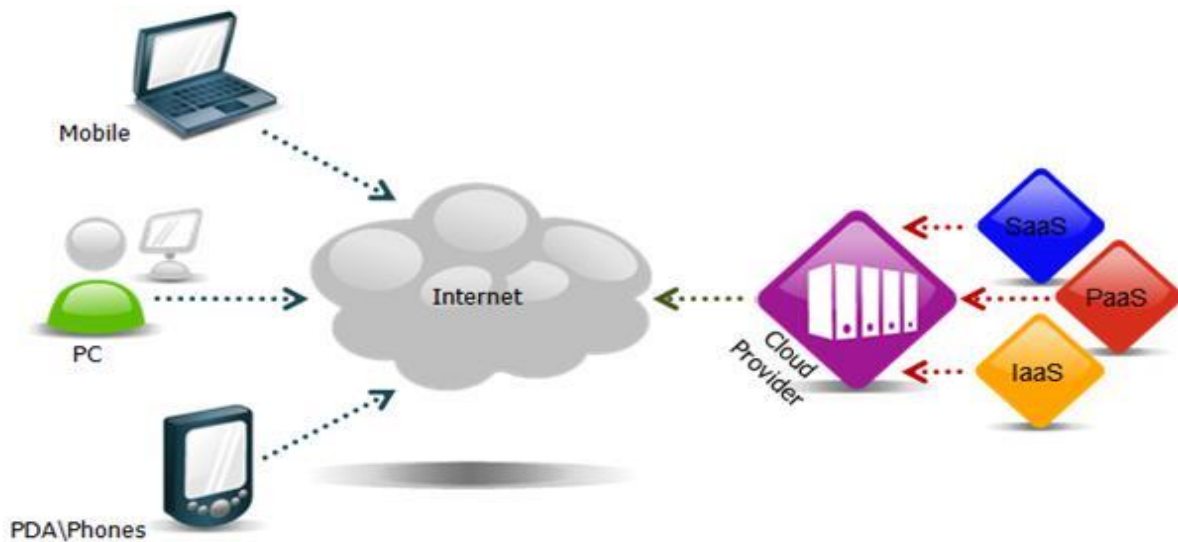
guide SMEs through the process of assessing their readiness towards adopting or migrating to cloud computing.

2 Current work and underpinning theory

2.1 Overview of current work

According to Mell and Grance (2011), cloud computing consists of the following main architectural layers: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). The figure below illustrates these architectural layers in the form of the cloud computing service models. It is not the intention of this paper to elaborate on these architectural layers.

Figure 1. Cloud service



Source: Indrasiri, 2012

There are four (4) types of cloud computing delivery mode. The first one is a public cloud which enables IT resources such as storage to be generally available to the public and accessible via the Internet. Internet access is a key for a requirement to access these services; therefore SMEs require access to the internet to benefit from this model. This is one of the factors that influence technological innovation readiness of SMEs. The second one is private cloud model which is meant for organizations that want more control over their data. Third one is the community cloud. According to Marinos and Briscoe (2009b), community cloud model effectively creates a micro-payment scheme by moving cost of service provision to the user base, which can dramatically lower the difficulty of market entry for innovative start-ups companies. It is arguable that the community cloud computing model could be befitting for SMEs because they can enter the market without requiring heavy up-front capital to invest in IT. Thus, the

derived model shares cloud infrastructure by multiple institutions or organizations with a common interest or concerns such as regulations, compliance, standards, and security requirements. The cost of these services is shared amongst community members, thus potentially saving ICT costs. The fourth and final mode is the hybrid model, which according to Kouyoumjian (2010), combines more than one different deployment models into a single model e.g., public combining with private cloud. With the hybrid approach, businesses take “advantage of the scalability and cost-effectiveness that a public cloud computing environment offers without exposing mission-critical applications and data to third-party vulnerabilities.” None of these authors Marinos and Briscoe (2009b) and Kouyoumjian (2010) argue that these models and their possible combinations could offer a means to technologically innovate SMEs. However, Mell and Grance (2011) argue that they could be used to determine the readiness of cloud

computing adoption by organisations (not excluding SMEs) to technologically innovate their businesses. To substantiate their argument, Mell and Grance (ibid.) suggest that depending on the IT services required an organisation can appropriate the capabilities of cloud computing models to its advantage. For instance, the *On-demand Self-service* capability of cloud computing could be beneficial to organisations (not excluding SMEs) in that an SME can independently acquire cloud computing services such as server usage and network storage space as and when needed without needing service providers' assistance. Thus, considerably, cutting time usually required for IT experts' intervention with service providers and thereby reducing time to market of their products and services. Given Mell and Grance (2011) suggestion, organisations (not excluding SMEs) can also benefit from *IT Resource Pooling* capability of cloud computing. That is where the cloud computing provider's resources are shared amongst many consumers, different virtual and physical resources are dynamically allocated and reallocated to consumers whenever demand arises. These resources are location independent and, customers generally have no knowledge or control over these resources. These resources include memory, server storage, processing power, and network bandwidth. In the case of SMEs, they usually concerned about running their core businesses; therefore resource pooling will benefit them as they would not be concerned with managing IT resources. Cloud computing capabilities such as *Broad Network Access* as also suggested by Mell and Grance could help organisations (including SMEs) to technologically innovate their businesses to improve their products and services to their customers at a lower operational cost. This capability allows services to be offered via Internet and is accessed through standard means that support the use of mixed platforms such as thin or thick platforms and to be accessed by using wide range of equipment such as tablets PC, smart mobile phones and personal computers. The *Measured Service* capability of cloud computing services creates the possibility for 'Pay as you use' facility. The capability is a metering system which is used to automatically optimize and control resources. Thus resources can be easily monitored and controlled by providing transparency of utilized service for both the consumer (including SMEs) and the provider. In view of the objective of this paper, this capability is useful to SMEs as they cannot afford capital costs associated with acquiring IT resources. It also makes Service Level Agreements (SLAs) easy to manage, which is beneficial to SMEs as SMEs cannot afford the required expertise for such IT services. The fifth and final capability of clouding computing services beneficial to businesses (including SMEs) and suggested by Mell and Grance is *Rapid Elasticity*. This capability offers consumers the flexibility to automatically acquire services, instantaneously release the services, and be able to scale the services

upwardly and downwardly appropriately on demand. However, for businesses (including SMEs) to innovate their businesses technologically using any of this cloud computing capabilities depend on the degree of their readiness which is influenced by so many factors. Rogers and Scott (1997) and Cardozo, McLaughlin, Harmon, Reynolds, and Miller (1993) describe innovation as an initiative, practice, or product that is perceived as new by organization or an individual adopting it and is considered to be one of the main drivers for business's success. Furthermore, Rogers (1983), Moore and Benbasat (1991) and Rogers (1995) agree that there are factors influencing innovation and/or technology innovation adoption decisions. The adoption of new technologies of ICT by SMEs has been covered extensively by the research fraternity. Work done by Noor (2009), Berman (1997), Timmons (1999), El Louadi (1998) Bridge and Peel (1999); Fuller (1996), Bennett and McCoshan (1993), Chen and Williams (1993); Pollard and Hayne (1998); Van de Ven (1993) since the advent of the internet suggest that there are factors influencing adoption of innovative technologies. These factors ranges from perceive benefits, IT knowledge, relaxation of telecommunications regulations, technology adoption competition, internal and operational efficiency to using IT for strategic role. Given the reviewed literature, it is arguable that the readiness of SMEs to adopt technology such as cloud computing to innovate their businesses and to have a competitive edge over their competitors and large enterprise is a social construct. This is because it has embedded socio-technical factors that require a social theory as a lens through which to understand and interpret these factors. It was envisaged therefore that these factors would assist to determine the degree of readiness of SMEs to adopt technology innovation. The next subsection provides an over of the applied social theory.

2.2 Overview of enactment of technologies-in-practice

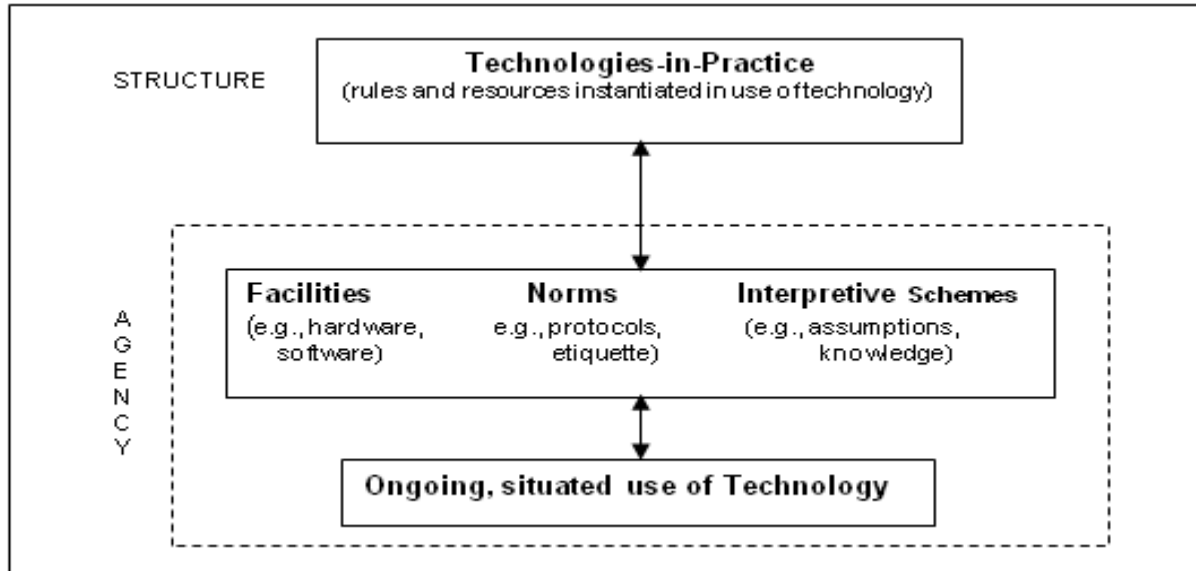
2.2.1 Background

The research applied the duality of structure (DoS) and action of Structuration Theory (ST) from the perspective of technologies-in-practice as a lens through which to understand the relationship between technology and organizations. Structuration Theory presents a practical framework for investigating the continuous social interactions that inform business practices (Pozzebon and Pinsonneault, 2001). Furthermore, ST is increasingly becoming well accepted theory in IS research (Orlikowski, 2000, 1992; Walsham, 1993; Rose and Scheepers, 2001; Pozzebon and Pinsonneault, 2001). In this paper, the focus has been on the SMEs in developing economies such as South Africa in adopting technology innovation to drive their business strategic objectives.

The DoS is therefore worthy of description. Orlikowski's (2000:407) argue that "...technology structures are virtual and are emerging from people's repeated and situated interaction with particular technologies. These enacted structures of technology use, which are termed technologies-in-practice, are the sets of rules and resources that are (re)constituted in people's recurrent engagement with the technologies at hand." Technology innovation such as

cloud computing becomes virtual technology structures emerging from people's repeated and situated interaction with internet and world-wide web. Therefore employing technologies-in-practice as a lens, readiness for technology innovation adoption by SMEs of developing economies can be teased out to identify what factors would determine the degree of readiness. The Figure 2 below illustrates the enactment of technologies-in-practice.

Figure 2. Enactment of technologies-in-practice



Source: Orlikowski, 2000

Given Figure 2 above, the determination of the degree of readiness for the adoption of technology innovation can therefore, be considered through enactment rather than appropriation (Twum-Darko, 2011:95). Deducing from the views of Orlikowski (2000: 409), properties of technology used in the context of innovation will be used in any instance and will not inherent or be predetermined, rather it will depend on what people actually do with them in particular instances. Schultze and Orlikowski (2004) applied technologies-in-practice model to understand the use of internet-based technology innovations such as business-to-business (B2B) situation. The following subsections describe structure, agency and time and space as applied in duality of structures and enactment of technologies-in-practice.

2.2.2 Structure

Structure refers to resources and guidelines frequently implicated in the enactment of technologies-in-practice. According to Giddens (1984), guidelines are techniques used in the enactment of social practices. The on-going use of technology strengthens technologies-in-practice, therefore becoming repeatedly used to carry out social life's demands. Given the conceptual framework in Figure 2 which

has been adapted from Figure 1 to guide the data collection instrument, data analysis and interpretation, SMEs' business objectives and type of resources they possess influence the way they do things, depending on, time or their circumstances. SMEs' interaction with cloud computing will therefore enact other social structures along with the technologies-in-practice as in cloud computing as a standard technology for SMEs.

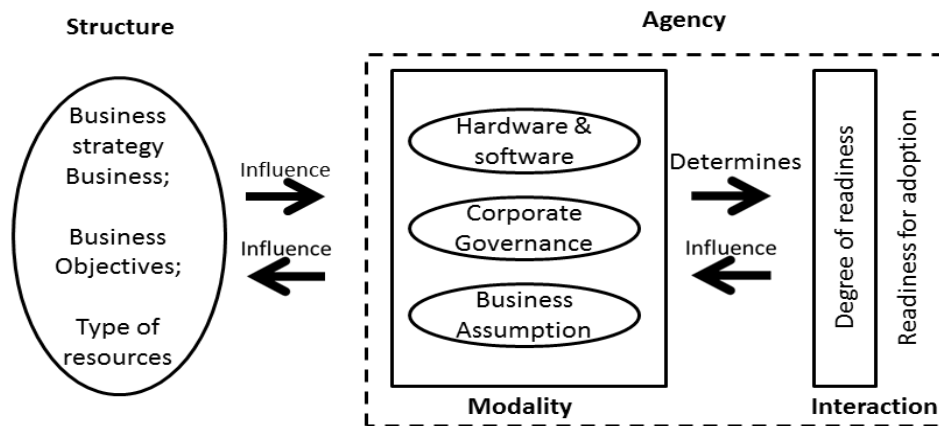
2.2.3 Agency

According to Giddens (1984) humans 'actors through their knowledge are capable agents that possess cognitive skills. He emphasizes the need to view agency's capability of doing things and not intentions people have in doing things. Giddens (ibid.) further argues that human agency is capable of making a difference therefore it makes the human agent powerful. The philosophy of Agency is that human actors are capable of doing things and as such possess power. Given Figure 2, human actors make use of facilities available to them such as computer software and hardware. They make use of protocols such as corporate governance as their guide to perform their day-to-day business activities. Actors use their knowledge from business strategy, strategic

objectives and available resources to derive business assumptions. Cloud computing provides a medium through which packaged solutions for SMEs can be structured to transform SMEs social interactions. SMEs are capable of using their power through their actions to influence and control the use of technology innovation such as cloud computing. Cloud computing embedded rules can only be accessed via

the internet will be able to transform norms, rules and communication practices of these SMEs. Thus, SMEs (Actors) apply their business knowledge (i.e., strategy, objectives, resources), facilities (i.e., infrastructure), corporate governance as modality to 'structure' their actions which in turn determine their degree of readiness to adopt cloud computing.

Figure 2. Conceptual framework



2.2.4 Time-space distancing

Time-space distancing concept involves the 'stretching of social systems across time-space, on the basis of mechanisms of social and system integration' (Giddens, 1984:377). Drawing from Giddens' assertion, the use of technology innovations such as cloud computing over time might influence the way IT resources are procured and consumed. Thus, over years they might become the way of life; a routine part of organization's culture. Hence, this can become the standard way of consuming IT resources if this social practice becomes reasonably stable over time and space. Cloud computing allows IT resources to be procured and consumed through the internet, and these services can be located anywhere in the world. Giddens (ibid.) further argues that "the structural properties of social systems exist only in so far as forms of social conduct are reproduced chronically across time and space." This is where globalization comes into the fore (Giddens, 1990). Thus, with technology innovation such as cloud computing, the possibility is that organizations no longer need many specialized skills to maintain servers and other IT capabilities on site.

3 Methodology

3.1 Overview

Welman and Kruger (2001:2) argue that different studies use different methods or techniques because they have different endeavours. Furthermore, Twum-Darko (2011) argues that interpretive case study

method in Information Systems (IS) research is suitable because of the advantage of gaining an understanding of a phenomena through the meanings people assign to them, by studying the IS and its environment within which its positioned. This research investigated a group of SMEs to examine their social patterns to determine the factors influencing their readiness to adopt technological innovation. Therefore, it is for this reason that the interpretive case study was employed as the most suitable approach for the study. The approach assisted in teasing out the complex factors that influenced technology innovation readiness of SMEs. Furthermore, the conceptual framework in Figure 2 which resulted from the analysis of literature and the underpinning through was used to guide the design of the data collection instrument. The study used semi-structured interviews to gather data (Merriam, 1998; Kvale, 1996; Sidani and Sechrest, 1996). It also examined SMEs' internal documents such as policies, strategies, committees/governance as "Agency" with the view to "structure" their approach to adoption of new technology innovations. The view is to gain better understanding of cloud computing in the context of SMEs, factors influencing their readiness to adopt technological innovations and to develop a general framework to determine the readiness of SMEs to implement cloud computing. The process of analysing data was made simple by ensuring that each interview question was complete and accurately answered. Accuracy was achieved by scrutinizing each response for any misleading answers provided (Morse, Barrett, Mayan, Olson, & Spiers, 2002; Stake, 1995). The case study was to look at SMEs in

Mpumalanga and Gauteng Provinces involved in therapeutic services, software development consulting, training and development consulting,

transport and logistics services. The table 1 below illustrates the unit of analysis:

Table 1. Unit of analysis

	Type of SME	Number of SME	Interviewee	Province
1	Therapeutic Studio	2	Owner/Director	Mpumalanga
2	Software Development Consultants	1	Owner	Mpumalanga
3	Transport and logistics	2	Owner/Director	Mpumalanga
4	Training and Development Consultants	1	Owner	Mpumalanga
5	Therapeutic Studio	3	Owner	Gauteng
6	Software Development Consultants	3	Owner/Director	Gauteng
7	Transport and logistics	2	Owner	Gauteng
8	Training and Development Consultants	2	Owner/Director	Gauteng
		16		

3.2 Enactment of technologies-in-practice (ETiP)

The analysis drew on the concept of duality of structure of Structuration theory and in particular, technologies-in-practice to analyse the case and the unit of analysis. In applying this theoretical framework, the duality of structure was used as a lens through which to understand, interpret and determine how technology innovation by SMEs forms a dualism. Giddens (1984) describes duality of structure as consisting of set of resources and rules that emerge from the actions of individuals through routines and practices. In enacting technologies-in-practice, attempt was made to determine how ICT resources and set of rules emerging from users of technology through their way of conducting day-to-day business create dualism. Furthermore, other concepts of structuration theory forming the dimensions of the duality of structure such as signification, domination, legitimation, interpretive schemes, facilities, norms, communication, power and sanction were also applied. The enactment process used as a lens helped to understand the relationship between technology and the SMEs which participated in the study. This concept was applied to understand and to determine the factors influencing technology readiness of these SMEs towards adopting technology innovation to drive their business objectives.

4 Results and discussion

4.1 Background

Given the Figure 2 above, the enactment of Technologies-in-Practice demonstrates how the structure and features of cloud computing reproduces the ever-changing interests displayed by SMEs over time. The outcome of the interviews suggests that, as a way of offering cost effective IT solutions, cloud computing proposes to provide an alternative to the traditional expensive IT solutions, as elaborated by the interview responses by the SMEs owners:

"... We are hosting our website at the service provider premises because we could not afford to procure our own in-house servers to be able to host our website in our premises" (SME owner, interview).

Eventually, cloud based solutions will challenge the legitimacy of the traditional IT systems as it was evident from the interview findings. Below are the responses from interviews with business owners:

"... Cloud computing can benefit our business tremendously, and I believe sentiments is commonly shared amongst other small and medium sized businesses" (SME owner, interview).

"... Google Docs tool is such a powerful tool and my business is using it to share documents amongst our employees" (SME owner, interview).

Giddens (1984) argues that human actors, through their knowledge, are capable agents that possess cognitive skills. He (op. cit.) emphasizes the need to view agency's capability of doing things and not intentions people have in doing things. Following this argument, SMEs' owners are capable of understanding the value of technology innovations and this was also evident from the interviews. Human agency is capable of making a difference therefore, a powerful agent (op. cit.). It is this power that enables SMEs owners to overcome factors that are negatively influencing their readiness to adopt technology innovation. This was affirmed by a business owner during the interview who commented that:

"... Now that my company has a website, I can compete with more larger companies as our business website and social media allows us to keep constant contact with our clients" (SME owner, interview).

Cloud computing based solutions as tools provide a medium through which packaged IT solutions for SMEs can be structured. As a result, they're able to transform their social interactions. SMEs are capable of using their power through their actions to influence and control the use of technology innovation such as cloud computing as elaborated in the interview with the business owner:

"... Cloud computing has transformed the way we do our business especially the way we

communicate with our clients because now we're using our website as a central communication medium with our clients" (SME owner, interview).

Cloud computing embedded rules are such that it can only be accessed via the internet which transforms norms, rules and communication practices of these SMEs. This was confirmed by the business owner:

... Our business used to issue placards for promotions information for our customers and now that we have a website, we're using it together with social media such as Facebook and twitter to communicate promotional information with our customers (Small business owner, interview).

The above comment reveals that norms, rules and communication practices of SMEs have transformed the cloud computing innovation technology.

4.2 Enacting technologies-in-practice

4.2.1 Structure

Structure refers to resources and guidelines frequently implicated in the enactment of technology-in-practice.

According to Giddens (1984), guidelines are techniques used in the enactment of social practices. The on-going use of technology strengthens technology-in-practice, therefore, becoming repeatedly used to carry out social life's demands. SMEs' business objectives and type of resources they possess influence the way they do things depending on time or their circumstances. The findings from the interviews showed that SMEs' interaction with cloud computing will therefore; enact other social structures along with the technology they are using. This was confirmed by the business owners:

"... My business does not require office space; as my team of software developers located at different locations are able to collaborate using closed based tools, such a Google Docs. This is very beneficial to my business because I do not have to rent or buy office space thus saving costs" (SME owner, interviews)

For example, the Table 2 below illustrates responses from SMEs interviewed when asked: "could cloud computing be a standard technology for SMEs?"

Table 2. SMEs organizational environment and cloud computing context

Broader Environment	SMEs Organizational Environment	Cloud computing Context
- South African national department of communications implements ICT Policies that are favourable to SMEs - Poor national ICT network infrastructure, poor connectivity and high cost of bandwidth - Telkom's monopoly over telecommunications infrastructure - Communications regulator introduces a range of reforms - Euphoria over the internet and cloud computing's potential to revolutionize markets. - Introduction of new Internet service providers to increase the competition - Cloud computing and the evolution of the data centres - Global requirement for greener IT Solutions - Globalization of IT resources	- Lacks access to funding because they are regarded as high risk by the banks - IT solutions tailored for specific environments and consumers. - SMEs usually does not have ICT strategy in place - SMEs are generally low users of IT resources - Lower number of employees - SME plays a very important role in national economies.	- Need for Pay as you use and on-demand computing infrastructures for companies - Lack funding required invest in IT infrastructures - Lack of IT skills required to run traditional internally developed systems - Need for cheaper IT solutions

Source: SME owners' interviews, 2013

4.2.2 The agency

Drawing on Twum-Darko (2011: 201-208) the table below illustrates how the interpretive scheme through which people in their daily social activities draw on the structures of signification. As observed from the

interview outcome, large companies were able to pull in on their structures of signification. This interpretation facilitates the leveling of the 'playing field' between large and SMEs businesses. Interview findings revealed that the increased use of internet and smart mobile applications for daily business

activities such as email services ‘empowers’ SMEs with tools and knowledge run their business efficiently. However such structures of signification do not go unopposed because of the high prices of broadband. Reiterating, the philosophy of Agency is that human’s actors are capable of making decisions such as which IT tools they require; as such they possess power. Technology users are human actors and make use of facilities available to them such as

internet and hardware. They also make use of protocols such as corporate governance, policies, and standards as their guide to perform their day-to-day business activities. The outcome of the interviews illustrated in Table 3 below suggests that SMEs applied their business knowledge, facilities, corporate governance and strategy as agency to ‘structure’ their current action which in turn determined their degree of readiness to adopt cloud computing.

Table 3. Enacting structures of signification

	<i>Cloud Service Providers</i>	<i>SMEs Companies</i>	<i>National Department of Communications</i>
Structure	The growth of internet and improving bandwidth speeds being introduced. A need to penetrate SMEs markets.	Lack of ICT skills and no ICT strategy.	Lack of proper policies to reduce broadband costs. Lack of market friendly policies favouring SMEs
Modality	Expert knowledge of cloud computing technologies	Use of internet to facilitate business.	Telecommunication Regulator and department of Communication
Interaction	Accountability in creating solutions for all market segments	Accountability in developing ICT strategy.	Accountability for addressing high bandwidth cost by regulating industry.

The issue of cost came very high during interviews with SMEs as a main factor influencing the readiness of SMEs to adopt ICT. Cloud computing based innovation technologies are one of the key techniques in which cloud service providers is seeking to ‘empower’ its customers with cost effective ICT solutions. However, the high cost of bandwidth is somewhat constraining the adoption cloud based technologies. Nonetheless, as observed by the analysis of case studies, the cloud based innovation technologies will seemingly continue to drive the adoption of ICT by SMEs. A remark below by a SME owner also indicated the cost of internet as a major factor to technology innovation adoption readiness in the small business segment.

“Internet in South Africa is too costly; in fact telecommunication companies in South Africa are ripping us off” (Small business owner, interview).

4.2.3 Time and space distancing

IT solutions designers typically draw on structures of signification (e.g. continuous use of cost effective approach for consuming IT solutions), through their interpretive schemes (e.g. SMEs’ Business knowledge gained from experience and general business skills) which allows them to understand the requirement of ‘cost efficient’, ‘simplified’, ‘highly available’ and ‘flexible payments’ solutions specifically designed to cater for different businesses. Drawing from the interview results, in the context of SME companies, cost effective and simple IT solutions are very desirable. From the interviews, one of the Software Development SMEs, has a team of 5 software developers and two directors (also as owners) who

work at remote locations and connected via internet without having to work in a single office space. The companies’ documents are stored online using Google’s Docs cloud computing service; this service is available at no cost. The developers are able to share these documents and collaborate online and are available all the time in real-time and can be accessed from anywhere. This allowed the company to save on electricity, office space and all costs associated with renting office space. This company is has reduced operational costs considerably by using this technology innovation. The Table 4 illustrates the key elements of cloud computing designer’s technology in practice; it lists examples of facilities (e.g. Hardware or software), norms (e.g. protocols, business etiquette) and interpretive schemes (e.g. assumptions, business knowledge).

However the cost of internet and security concerns have led to some compromises in which the value of these closed based IT solutions are challenged. This was the case with the Software Development Company as they pay more to access their documents by using the internet due to the high cost of internet connectivity. This was articulated by the frustrated business owner as:

“... we are using Google Docs document sharing service for our business documents, but when we download these documents we end up paying too much on internet, my feeling is that telecommunications companies are ripping us off” (Small business owner, interview)

Although Google Docs document sharing service is very beneficial to businesses, the cost of internet is constraining the SMEs from using these internet based solutions. The high availability of

cloud computing i.e., available 24/7 means structures of domination are tangled with structures of meaning and legitimization. Cloud based solutions promoted the time-space distanciation as cloud computing services can be accessed anywhere at any time. Overtime as

the cloud computing based services evolves; it will do so to meet the demands of SMEs. This is was also the case with software Development Company when they used Google's Docs cloud computing service.

Table 4. Cloud computing designer's use of technologies-in practice

Facilities	Norms	Interpretive schemes
• Internet/broadband • Load Balancers • Web technologies • Servers • Storage • Network bandwidth • Virtual machines • Firewalls • Disaster Recovery • Databases • Data Centres • Office space	• Requirements for access to finance • Income statement • Business practices • IT skill shortage • SMEs culture	• Policies on cost reduction • Standards for IT solutions • Guidelines describing ease of use • Regulations on types of usage and associated cost • Guidelines for 24/7 availability

4.3 Factors influencing technology innovation readiness of SMEs

These factors were established during the interviews conducted with small business owners as part of the case studies. They were analyzed by drawing from the conceptual framework established (Figure 2) to guide the data collecting and analysis. These factors are grouped under the main elements of enactment of technologies-in-practice - Agency and Structure.

4.3.1 The small and medium enterprise owner's attitude as agency

Small and medium sized business owner's attitude is one of the main factors influencing technological readiness. The day-to-day business conducts and activities of Agents (SMEs) influence their readiness to adopt technology innovation and their actions are governed by their attitude towards innovation Technology. The human agents (SME owner) as knowledgeable agents have their reasoning as they believe that technology innovations are hyped and are not adding value to their businesses. They therefore 'exert power' over decisions of whether or not to adopt technology innovation such as cloud computing. This was affirmed by SME owner during interviews who commented as:

"...When dealing with IT solutions there are facts and perceived things. Therefore, some IT tools are not adding value. The perception is that they are adding value. People usually go with hype and this view is shared amongst other SMEs. For example because I implemented a SAP system then other companies might follow suite without investigating if they really

need SAP in their businesses (Small business owner, interview).

However, when asked if the cloud computing can also be regarded as one of these IT innovation tools that are hyped and is not adding value to business; his response was that:

"...however cloud computing is an exception because he believes that it definitely does bring value to small and medium sized businesses" (SME owner, interview).

4.3.2 The lack of IT skills and ICT strategy as agency

Most SMEs in general do not have skills or resources to maintain their own in-house traditional ICT infrastructures. Reflecting on this point during interviews, the small business owner made the following remarks:

ICT skill are lacking in the country, if you do not have skilled people to run your IT infrastructure then it is impossible to run traditional IT infrastructure (SME owner, interview).

It is a general view that cloud computing does not require companies to have technical IT skills to be able to use it. Nonetheless, SMEs do need to develop their ICT strategy for them to understand the value that technology innovation can potentially bring to their businesses. SMEs are not considering ICT strategy as important for their business and this factor is negatively influencing their readiness to adopt technological innovation. This observation is reflected by the comment made by one of the small business owners:

Cloud computing is a good thing, it has a potential to benefit SMEs tremendously, the issue

would be would the SME be able to know the difference and would they be able to use it effectively? I feel that SME would need to understand the technology. The issue remain with the users. Not the basic understanding, they need to have a strategy. For the SME to use IT effective they need to have ICT strategy for technology just like they have other Business plans to execute business operations (SME owner, interview.)

4.3.3 Cloud based solutions benefits as agency

When asked “to what they think is the main benefit of cloud based IT solutions?” all the SMEs interviewed indicated the following as the main benefit for them.

“...The main benefit of cloud computing is that you do not need to understand the technology; you just simply use the technology” (SME owner, interview).

This means SMEs do not necessarily want to acquire skills to run internal traditional IT infrastructure. They need simple technologies which they can use without having to understand the deeper concepts behind the technology. Therefore they require simple solution tailored for them:

“... No cost on infrastructure and mobility, I can access my business anywhere and anytime. The model for paying as you go is also advantageous to my business. Buying your own infrastructure is impossible for my business as I do not capital expenditure to fund these projects” (Small business owner, interview).

4.3.4 Cloud computing perceived benefits as agency

Information Technology innovations benefits are not really tangible and difficult to understand because they generally cannot be quantified. This view is also shared amongst SMEs who commented that:

We're using Google extensively because Google has Google documents and most people are not aware of these tools (SME owner, interview).

When SME owners were asked how they would rate cloud computing implementation within their company, they answered positively. One SME owner replied with the following comment:

Implementing cloud computing was a total success in my company. The implementation were easy to setup, we're able to upload website contents at our own convenient time, it allows me to focus on business functions and to maintain business stability (SME owner, interview).

One of the Transportation and Logistics SMEs is using cloud computing multi-layered cloud based services to buy infrastructure to sell it to the other smaller companies. These services include web hosting.

4.3.5 Cloud computing offered as tailored-made solutions for SMEs as agency

Technology innovation designers ('Actors') have to develop solutions that are tailored for specific consumers such as SMEs. From the findings of this study it was observed that SMEs require technology innovation that can be tailored to suite them. These technologies should take into account factors such price, ease of use and high availability. This was affirmed by an SME owner who commented as:

I require IT services without worrying about infrastructure or its maintenance, what I care about is it must be available whenever you need it (SME owner, interview).

This assertion confirms that SMEs requires solutions which are tailored to suite them and cloud computing fits that. This means that the more designers innovate these types of cloud based solutions the more SMEs will become ready for technology innovations. This is one of the factors that influence them.

4.3.6 Trust issues as agency

Trust issues were listed amongst the key factors influencing technology innovation readiness of SMEs. The SME owner was offered an innovative solution to do all their administration online by using a toll provided by their Banking institution for free. This toll allows the SME to link all its business accounts and automate Human Resource functions such as payment of salaries etc. The owner did not take up the offer because he does not trust the technology for critical business processes. The SME owner during an interview gave the following explanation for not taking up the offer:

We had an offer for a free accounting cloud based solution hosted by the Bank. Part of the solution is to link the application with the business accounts. We did not take up the service because we did not trust the solution with our money. We know that linking them would have made life easier. One of the biggest issues is the lack of ICT skills and ICT competency. If I had ability to control the system then I would have trusted the solution (SME owner, interview).

Cloud computing vendors must make an effort to explain the security capabilities of their technologies to promote this trust gap. The SME owner further commented:

There is lack of trust in general for cloud computing providers; I feel that I cannot trust the cloud computing services providers because I do not get to meet them. I feel my business data will be compromised. But the more people use them I feel better and gain trust (SME owner, interview).

Small and medium sized enterprises' owners do however recognize the benefits that technology

innovation can bring to their business. One owner further commented that:

I could see that the technology innovation will really benefit the business; however I could not trust the internet enough to take up the innovative service offered by the Bank (SME owner, interview).

Trust is a major factor in cloud based environments and has a major influence on the readiness of SMEs towards adopting cloud computing and has impact on various people around the world. Trust is challenging the significance and legitimacy of cloud computing and therefore plays a very vital role in its sustenance and acceptance by SMEs.

4.3.7 Connectivity/bandwidth costs as a structure

Connectivity, in the views of the interviewees, was a key barrier for them towards accessing cloud computing services, especially that the cost of broadband is too high. Lohrke, Franklin, & Frownfelter-Lohrke, (2006) argue that the high cost of bandwidth is not impacting on large companies because they are able to negotiate better and cheaper contracts with telecommunication companies simply because they're high consumers of broadband. They therefore have power to negotiate good terms of lower rates with telecommunication providers. This was confirmed by the owners of SMEs interviewed:

The cost of internet is too much in South Africa. In fact telecommunication companies are ripping us off. The internet connectivity is also not reliable; the quality of service has dropped significantly over the years. The new service providers are much better than the old major service providers (SME owner, interview).

The pay as you use payment model of cloud computing It is very relevant because one of the key challenges for SMEs is cash flow, we do not want to tie cash on long term contracts. We need to avoid vendor-lock in (SME owner, interview).

4.3.8 Cloud computing business process impact as a structure

Cloud computing have impact on the SMEs business processes ('structure'). This in turn influences their readiness to adopt cloud based solutions. This was confirmed by SME owner who commented:

Cloud computing has changed our business processes over time, it impacted the business positively. A lot of things we did manually use to take time, now that we're using cloud computing most things are automated. Example now we can update price list on the website without having to manually email price list to our clients or refer them to the website. We have also integrated social media to our systems and this benefits the business because we're communicating with our clients at multilevel and we're always in contact with the clients (SME owner, interview).

4.3.9 Market pressure and perceived benefits as a structure

SMEs owners are usually not aware of the benefits technology brings to their organizations. Some SMEs are driven by market pressure ('structure') when deciding on technology innovation without looking into whether or not the technology will benefit the business. SME owner commented as follows:

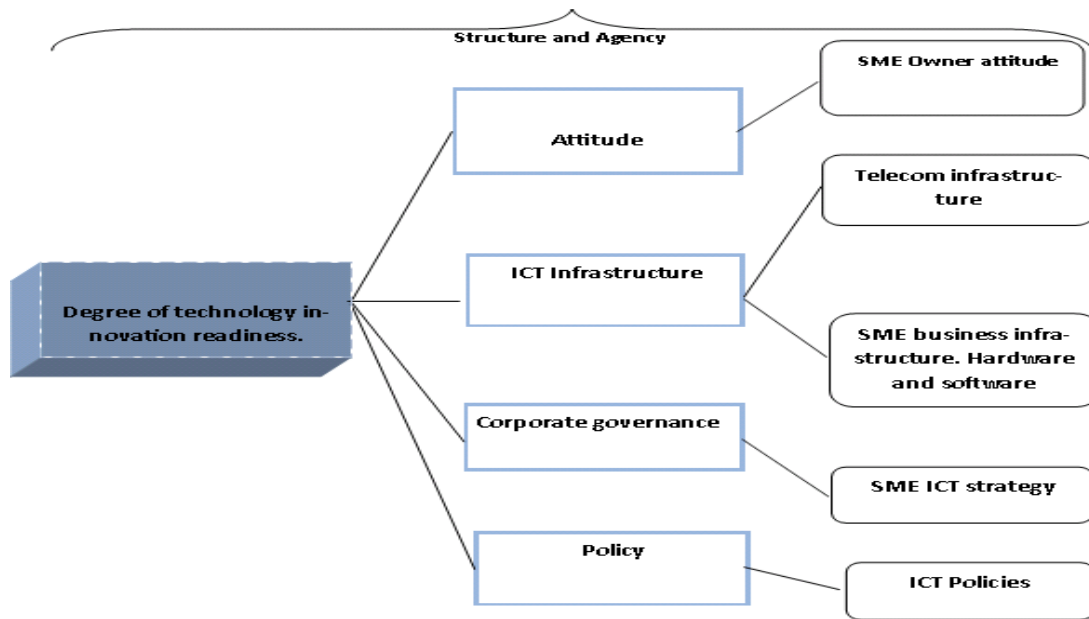
"... You find that SME businesses are using technology but the technology does not have effect into their business, example having a website does not impact the business because it depends how you use that website. Having website does not meaning that it is helping to market the business. I know of a SME company that is having a website and the business is doing very well; however that owner does not attribute the success of the business to the website; instead believes the business is doing well because he is getting customers through word of mouth because the website has low hits. Therefore the website is not necessarily giving them any competitive edge and is not adding value to the business" (SME owner, interview).

This raises questions whether or not some of these innovative technologies really have positive effects on businesses. Drawing from the above comment, this can be attributed to the attitude of SME managers towards technology innovations. This is because they do not regard IT as an important tool to assist them in achieving their business objectives.

5 Conclusions and recommendations

5.1 The general framework

The main objective is to determine the readiness of SMEs in South Africa to adopt technology innovation such as cloud computing as a case study to meet their business objectives. The general objective is to adopt a general framework that will guide SMEs through the process of assessing their readiness towards adopting or migrating to cloud computing. The research questions were: what are the factors influencing technology innovation readiness of SMEs and how can cloud computing benefit SMEs towards meeting their business objectives? The answers to these research questions led to the refinement of the conceptual framework of Figure 2 to Technology Innovation Readiness Assessment (TIRA) framework illustrated in Figure 3 below. The framework affirms the argument made by Twum-Darko (2011:95) that the determination of the degree of readiness for the adoption of technology innovation can therefore be considered through enactment rather than appropriation. The paper describes the artefacts that form the Technology Innovation Readiness Assessment framework as depicted on the figure 3:

Figure 3. General framework - the technology innovation readiness assessment (TIRA)

5.1.2 Attitude

The attitude refers to the current characteristics SME owner or SME business IT manager towards technology innovation such as cloud computing. SME owner's attitude can be used to measure the extent to which he/she is aware and interested in the adoption of innovative technology. Therefore the owner's attitude is a big factor which influences the readiness of SME business to adopt technology innovation. On this basis, whether an SME business adopts cloud computing or not, will be dependent on SME owner's attitude towards that technology. The research findings have indicated that SME companies are generally having a positive attitude towards technology innovation.

5.1.3 ICT infrastructure

Cloud computing ICT infrastructure is based on the availability of good telecoms infrastructure. The success of technology innovation such as cloud computing depends on the development of telecommunications infrastructure that offers fast speed bandwidth/internet connectivity and cost effectively. SMEs need to look at the following indicators to measure their technology innovation readiness from ICT infrastructure perspective:

- a) The availability of ICT infrastructure within their business area required to migrate to cloud computing
- b) The extent through the cloud based solution will support their business
- c) The availability of hardware and software to access cloud based services. For example, the business needs to have some web base browser to

connect to the internet and access cloud bases solutions.

5.1.4 Corporate Governance

Corporate governance refers to that business operational strategy to implement cloud computing. It was mentioned earlier from the research findings that SMEs need to build ICT strategies in order to understand the impact that technology innovations can bring to their businesses. The governance must also ensure that business allocates budgets towards technology innovations. SMEs' governance's input to readiness assessment can therefore be measured by the following indicators:

- a) The existence of ICT strategy, which clearly defines the SMEs' position on technology innovation
- b) Cost cutting measures expected by adopting technology innovations
- c) The SME owner responsibility and role in cloud computing
- d) Allocation of budgets for technology innovation initiatives

5.1.5 Policy

Policy reforms and initiatives from government are vital to enable favourable environment for the national development of ICT. Policies are there to set regulatory framework required for telecommunication sector. SMEs need to be aware of these ICT policies to understand how they impact their business objectives of adopting technology innovations.

5.2 SMEs environment scanning

5.2.1 External environment

The goal of external environment scanning is to identify the environment factors that might impact the business in its decision to adopt technology innovation, factors such as telecommunication regulatory framework and government policies. SMEs need to evaluate the cloud vendors, the bandwidth infrastructure availability within their business areas, the cost of internet and IT infrastructure required to access cloud-based services. The following are the key external environment factors to consider accessing readiness for technology: (a) Cloud providers; (b) IT Infrastructure; (c) Bandwidth Availability; (d) Cost of Bandwidth.

5.2.2 Internal environment

The goal of doing internal environment scanning is to identify the environment factors which could impact the business in its decision to adopt technology innovation. The following are the key external environment factors to consider accessing readiness for technology: (a) SME Experience; (b) Owner's Attitude towards technology; (c) Financial health; (d) ICT technical skills; (e) Culture; (f) Organizational Structure.

5.3 Recommendations

The Software as a service (SaaS) is a recommended deployment model for SMEs. Individual SMEs can use public cloud as it is cheaper to acquire and does not require technical know-how. SMEs can also group themselves and use community cloud, as they collaborate and share their similar experiences for mutual benefit and compete equally with larger enterprises.

5.4 Contribution

Given the results of the case studies, and the analysis and interpretation thereof, the general framework developed and discussed could be used by SMEs to assess their readiness to adopt cloud computing technology innovation. The framework can be used to guide the process of decision making about whether or not to adopt or implement cloud computing in their businesses to ensure that their businesses are ready for such innovative technology. The framework also exposes all factors to be considered during this decision making process. Furthermore, the methodological contribution of using Enactment of Technologies-in-practice concepts of Structuration Theory to analyze and interpret the results of the case studies could be said to be exciting and ground-breaking. The approach used in this research study can be useful to other researchers pursuing similar

studies and those who have vested interests in studies relating to the development of SMEs especially in developing nations. Clearly the general framework – TIRA - provides the basis for a systematic process and guidelines to implement innovative IT solution such as cloud computing. Instead of seeing such an exercise as simply an IS implementation problem, TIRA gives due recognition to the social processes underlying such an implementation process. Therefore, it does not only address the technical aspects of the technology artefact; but it also addresses the social aspects of SMEs (i.e. attitude towards innovative technologies), this subsequently changes the way SMEs view technology innovations such as cloud computing.

The paper reflected well on seasoned thinking and also thoroughly applied the theoretical insights outlined to provide analysis of the investigation conducted on the SMEs? The cloud computing innovative technology paradigm in recent years is rapidly gaining momentum as an alternative to traditional approach to provide or consume IT services and resources. It has revolutionized the Information Systems world and this has generated a massive interest from different scholars and research practitioners who are interested in understanding the advantages of Internet based IT applications towards small and medium sized businesses. Although, the adoption of this technology innovation promises various benefits to an organization, a successful adoption and implementation of cloud computing in an organization requires them to understand certain factors. The adoption of cloud computing platforms and services by the scientific community is still fresh as the performance and financial benefits for scientific applications are not yet clear. However, currently there are inadequate guidelines to guide SMEs in developing economies to determine their degree of readiness to adopt technological innovation such as cloud computing. As such it was crucial to conduct an empirical study in the context of SMEs to gain better understanding of the factors that influence their readiness to adopt technology innovations such as cloud computing. Furthermore, there is a need to develop a framework or roadmap that provides SMEs with number of approaches that can be used to successfully adopt cloud computing.

This roadmap can be used by interested research practitioners as groundwork to further study this research area particularly in developing countries. In this way, it contributes to the discourse on a new approach to implementing innovative IT solutions in South Africa and elsewhere. The study has a wide variety of interests from the researcher, the supervisor, external examiners and academics who are involved in the development of information and communications systems to the advancement organizations and in particular, small and medium-sized enterprises. The paper might also interest researchers involved with issues of IS related

initiatives for global development. Furthermore, it might interest national government or other international organizations agencies such as, European Commission, The Council for Scientific and Industrial Research (CSIR) in South Africa, Industrial and SME Research Centre of India (ISRCI) that are mandated to looking at ways to implement and introduce SME friendly policies to aid the development of their economies. It became very clear during the fieldwork of this study, that this research is part of a wider area of research within the international IS research community. It can positively be stated that this paper will significantly instigate more future research studies as cloud computing itself is an interesting topic attracting wide interests. It is strongly believed that the findings of this study are applicable globally as SMEs operate globally. Its application is more applicable in particular to developing countries and emerging economies like that of South Africa because they rely on SMEs to create jobs and to develop their economies.

5.5 Limitation and future research work

Cloud computing has emerged as one of the best recent technology innovations. Early adopters such as SMEs of cloud based services are embracing the opportunity to access best IT solution at a lower cost. Academic literature on cloud computing has been covered very extensively since its foundation; however there is little literature coverage of cloud computing in the context of SMEs and there was no readily available framework that SMEs can use to access their readiness to cloud computing. This research has gone a long way in addressing this because it developed a framework that serves as a guide that SMEs can use to determine and assess their technological innovation readiness. However, cloud computing paradigm is still evolving and technology innovations are broad. This research has therefore just scratched the surface as it only addressed the context of cloud computing. More future research work is required to expand the knowledge on factors that influence technology innovations readiness. Finally, it is recommended that further studies be done to include broader population of SMEs of study from different countries will be conducted to further examine the theoretical validity and empirical relevance of the TIRA model. It is also recommended that further studies be conducted to tease out the degree of readiness of SMEs to adopt technology innovation such as Cloud computing.

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