BARRIERS TO INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ADOPTION AND USE AMONGST SMEs: A STUDY OF THE SOUTH AFRICAN MANUFACTURING SECTOR

by

PRIYAL PILLAY

Student number: 0411076G

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Supervisor: Dr Jose Barreira

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ABSTRACT

This paper aims to look at the barriers of ICT adoption amongst Small to Medium Enterprises (SMEs) in South Africa, specifically in the high growth-manufacturing sector. The population of the study is comprised of manufacturing SME owners and managers in Gauteng, South Africa. The objectives of this study are threefold. Firstly, it aims to establish which ICTs SMEs are currently making use of in South Africa. Secondly, it will analyse the perceived value added to SMEs through ICT adoption. And thirdly, the study endeavours to unearth the various barriers faced by SMEs when adopting ICTs.

The research consists of data collection from 81 SMEs in the manufacturing sector in Gauteng, South Africa, by means of an online questionnaire. The data was analysed through a variety of statistical techniques covering both descriptive statistics and multivariate analysis. The following conclusions were reached:

- Three barriers examined are significantly important to the adoption of ICTs, namely lack of existing hardware, immediate return on investment (ROI), and lack of infrastructure.
- The perceived value of ICT has a positive, significant relationship to ICT adoption.
- The majority of SMEs still predominantly make use of general ICTs, with more advanced ICT use lagging behind significantly. The majority of respondents have Voice Over Internet Protocol (VoIP) phone services (69%), Internet access and e-mail (90%), as well as telephone (89%) and fax (82%) services as ICTs that have already been implemented.
- The education level of the owner/manager has a significant, positive relationship with the level of ICT adoption, particularly amongst general-use ICT and production- integrating ICT.

DECLARATION

I, ____Priyal Pillay_____, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

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Signed at …………………………………………………………………………………

on the …26th….. day of …February…………… 2016…

DEDICATION

To my I wife, Joelene. Thank you for all your support and patience throughout this challenging journey. I love you.

ACKNOWLEDGEMENTS

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this study is to investigate the extent to which Small to Medium Enterprises (SMEs) in South Africa are making use of Information and Communication Technology (ICT), as well as the barriers to ICT adoption amongst South African SMEs within the manufacturing sector.

SMEs play a vital role in all economies, particularly those of developing countries like South Africa where there are substantial employment and inequality challenges. Unfortunately there are also numerous barriers that prevent SMEs from operating successfully. Access to information is one such problem experienced due to a lack of ICT infrastructure. Information access plays a critical role in informed decision-making processes, making it easier for SMEs to make good competitive decisions (Modimogale & Kroeze, 2011).

It has been argued that ICTs have the potential to add substantial value to the output and the competitive position of SMEs. Hence, in order to compete on a broader scale, the numerous benefits of ICTs need to be taken into consideration and awareness thereof needs to be raised (Ismail et al., 2011).

1.2 Context of the study

The ICT revolution has affected the way people and businesses share information and is vital to opening up access to knowledge and information, and influencing economics. From South Africa's perspective, it is neccesary to understand how this sector functions and what processes are needed to best maximise its potential (Hanna, 2010).

ICT incorporates primary digital technologies like mobile phones, computers

and other digital communication media used to collect, organise, store, process, analyse and communicate both internal and external to organisations (Ritchie & Brindley, 2005). However, SMEs are often slower to adopt, or have increased difficulties adopting these new technologies in their businesses. Currently the widespread uses of ICTs are changing the ways in which people and companies operate. It is a feature of the technological advancements of this period in history where there has been immense innovation in information management and communication so that in many countries, information and knowledge are easily conveyed, accessed and used (Barba-Sánchez et al., 2008). Hence, the speed of technological change and what is available for use by firms has revolutionised how they interact which, in turn, has changed the way business is done and how businesses compete in the marketplace. (Modimogale & Kroeze, 2011).

1.3 Problem statement

1.3.1 Main problem

According to Ritchie and Brindley (2005), ICT plays a very important role in the current knowledge economy. Both traditional and newer ICT tools add increasing value to SMEs and are thus important for the competitiveness of the business. It is imperative for SMEs to become part of this economy in order to compete and thrive in the future. The challenge is that SMEs face many barriers to ICT adoption and mainly make use of traditional/basic methods in order to remain competitive, rarely taking advantage of the available ICT tools. The purpose of this research is to investigate the extent to which SMEs in South Africa are making use of ICT, as well as the barriers to ICT adoption amongst South African SMEs within the manufacturing sector.

1.3.2 Sub-problems

- To understand the adoption and use of ICT by SMEs.
- To determine the barriers to ICT adoption and use.

- To determine the value obtained from the use of ICT in South African SMEs.

1.4   Significance of the study

The nature and extent of ICT adoption has been explored quite extensively in recent research, though in Africa such work is still limited. While over the last decade or so theree have been noteable improvements in the ICT sector in Africa, there are still numerous structural challenges. However, the potential is infinite and if harnessed correctly can be ifluential in adressing social and economic challenges in the continent (Frempong, 2011).

In cross-country studies of growth that mostly include both developed and developing countries, the availability of telecommunications infrastructure is generally found to contribute significantly to GDP growth, alongside other knowledge related indicators such as education. This implies that with the necessary investment in communications infrastructure and complementary factors at the same time, considerably higher growth rates can be achieved (World Bank, 1998).

The SME sector has an important role to play in economic development, poverty reduction and employment creation in developing economies (Hallberg, 2000). As previously mentioned, nowadays the business world has been deeply influenced by ICTs and the application thereof amongst businesses is widespread. ICTs are rapidly changing global production, work and business methods, and trade and consumption patterns in and between enterprises and consumers (Alam & Noor, 2009). In South Africa, the New Growth Path (NGP) identifies manufacturing as one of the six core pillars of growth that will drive the South African economy. The NGP envisages that as many as 80,000 jobs can be created in South Africa in the manufacturing sector by 2020 and identifies the SME sector as playing a key role in this development (SEDA, 2012).

The findings of this study are expected to benefit ICT service providers, government policy makers, business leaders and SMEs in the manufacturing sector. Of particular significance is that the results from this research are

envisaged to generate new knowledge and also to motivate individuals to investigate any knowledge gaps that may still exist.

1.5   Delimitations of the study

- Only South African SMEs were sampled. The sample consisted of SMEs within Gauteng, South Africa. Micro enterprises and survivalist enterprises as defined in Section 1 of the National Small Business Act (1996) were excluded from this research.

- Data was collected from SMEs in the manufacturing sector. This sector was selected due to its high growth potential and impact on the South African economy.

- No preference was given to urban and rural SMEs as long as they were situated within the Gauteng region.

- The questionnaires were directed to the owners of the firms as well as managers.

- Questionnaire responses were gathered over a period of three months to allow sufficient time for response. Multiple follow-ups with respondents were done to ensure that the questionnaire was answered.

1.6   Definition of terms

1.6.1 Small and medium enterprises

This research will follow the definition of the National Small Business Act of 1996 which states that small to medium enterprises should comprise a minimum of 50 employees and an upper threshold of 200 employees (DTI, 2008).

1.6.2 Information and communication technology (ICT)

ICT encompasses a range of technologies, information and resources. Selwyn (2002) argues that the term Information and Communication Technology (ICT) can be viewed as an umbrella term for a wide range of

technological applications which include digital broadcast technologies, telecommunications technologies, and electronic information resources.

Similarly to Selwyn, Ritchie and Brindley (2005) define ICT as an array of technologies used to collect, store, process and communicate information within an enterprise. Lucchetti and Sterlacchini (2004) further categorise ICT into the following groupings: general-user, production-integration and market-oriented groups. These categorisations relate to the roles of ICT or the strategic position that ICT can play within a particular SME.

General-user ICT group: This refers to very basic ICT implementation, which includes commonly used fax, e-mail and Internet. The levels of adoption at this stage are generally high and are not dependent on the size of the business. At this level, technology is usually introduced into the business in small doses and is not coordinated.

Production-integrating ICT group: These are more advanced than the general-user ICTs and are either linked to the production processes carried out within the firm or based on inter-firm relationships. They are expensive and require the relevant technological skills in order to be carried out (Lucchetti & Sterlacchini, 2004).

Enterprise resource planning (ERP), customer relationship management (CRM) and mobile payment systems are some examples of applications and tools at this level. Generally, applications under this group rely on networked technologies and, according to Galloway and Mochrie (2005), this "has transformed the capacity of SMEs to share and transfer information."

Market-oriented ICT group: This ICT grouping refers to the firm's web presence, displaying the goods and the company information on the Internet. Some websites may have e-commerce functionality, such as offering the ability to place orders. This relates to the marketing aspect of the business and most recently also includes social media tools and promotion (Lucchetti & Sterlacchini, 2004).

CHAPTER 2: LITERATURE REVIEW

2.1   Introduction

Previous studies on ICT adoption have shown that SMEs in developing countries have not fully taken advantage of technological developments to extend their businesses beyond traditional borders (Humphrey et al., 2004). Hence, there is a need for a better understanding of the determinants of ICT usage and factors that drive or constrain its adoption and use (Harindranath et al., 2008).

Gagnon and Toulouse (1996) maintain that the use of ICT in business is no longer an option but rather one of survival, with a better understanding of the process of adopting new technologies as both essential and urgent. Similarly, Lawson et al. (2003) maintain that organisations that do not embrace new technologies will eventually be left behind. A study carried out by Caldeira and Ward (2002) in Portugal showed that SMEs that were doing well locally were unable to compete with firms which used more aggressive business methods and tactics and, as a result, found their market share eroded.

Whilst ICT adoption studies constitute a significant area of research within the developed world, there continues to be a need for better understanding of the adoption and use of ICTs within the specific context of SMEs in emerging economies.

2.2   Background discussion

In this chapter, the literature pertaining to both SMEs and ICTs will be reviewed. The SME sector will be described in detail, also focusing on the importance of SMEs in emerging economies such as South Africa. Key ICT adoption models will be described at length and an in-depth analysis of the

literature on the value that ICT could add to businesses will be undertaken. Furthermore, related studies on the impact of ICT on competitiveness and performance will also be discussed. Porter's value chain model is used to form a theoretical basis for the value added by ICT.

The chapter then looks at the barriers to ICT adoption and why SMEs have difficulties in adopting ICT in their businesses. The analysis looks at the main reasons for businesses not adopting ICT, namely: 1) ICT is unsuitable for the type of business; 2) there is an absence of knowledge about the use of ICT; 3) there are insufficient IT skills; 4) there are specific perceptions related to the high setup cost of ITC; and 5) reasons relating to the constantly evolving ICT environment.

Following the theoretical grounding of all the above-mentioned concepts, the hypotheses and sub-problems relating to the literature are presented.

2.2.1 The SME sector

There is no common definition of SMEs that is widely accepted as they can vary according to size, age, sector, motivation, mode of organisation, ethnic background, location, knowledge base, power and control of resources and innovative capacity (Vivienne & Roberts, 2005). In the EU, for instance, an SME is defined as a firm with fewer than 250 employees or annual turnover of less than ECU 40 million. In the South African context, these thresholds are too high, and would lead to over 90% of all firms (including listed companies) being classed as SMEs. In South Africa, SMEs are therefore classified as micro, very small, and small or medium enterprises (also referred to as SMMEs) with varying ceilings for each individual sector.

SMEs are often distinguished by the nature of their production and management arrangements, trading relations, financial practices and internal competence (Lukács, 2005). A large proportion of studies have examined the differences in management style between large businesses and SMEs. These studies have identified that, among other notable characteristics, SMEs tend

to have a small management team (often one or two individuals), they are strongly influenced by the owner, they have little control over their own environment and they have the desire to remain independent (Dennis, 2000).

In South Africa, SMEs can be classified as micro, very small, and small or medium enterprises (also referred to as SMMEs) with varying ceilings for each individual sector. This research will follow the definition of the National Small Business Act of 1996, which states that SMMEs should comprise a minimum of 50 employees and an upper threshold of 200 employees (DTI, 2008).

The value of the small business sector is recognised in economies worldwide, irrespective of the economy's developmental stage. The contribution to economic growth, job creation and social progress is highly valued and small businesses are regarded as an essential element in a successful formula for achieving economic growth (Vosloo, 1994). Matlay and Weathead (2013) observed that SMEs are generally regarded as the "backbone of the economy." According to the authors, the business of SMEs constitutes the main source of economic growth and development in developing countries. Wolf (2001) found that in most African nations, SMEs account for a significant share of production and employment and are, therefore, directly connected to poverty alleviation. SMEs are especially challenged in developing countries by the globalisation of production and the shift in the importance of various determinants of competiveness.

Researchers have shown that SMEs employ large numbers of people and greatly contribute to the national income (Berger, 2012; Mingaine, 2013). However, studies in China, the USA, Kenya and other African countries show that the contributions of SMEs are not the same across all enterprises (Mingaine, 2013; Mutwiri & Mingaine, 2014). According to Reynold (2010), those small enterprises which survive play a much more important role in national development. A thriving SME sector contributes to the economy by creating more employment opportunities, increasing production levels and paving the way for greater entrepreneurship and innovation. The dynamic role of SMEs in developing countries sees them as engines through which the

growth objectives of developing countries can be achieved (Hobohm, 2001).

It is estimated that SMEs employ 22% of the adult population in developing countries. A study conducted by Abor and Quartey (2010) shows that 91% of formal business entities in South Africa are SMEs and that these SMEs contribute between 52% and 57% to the GDP and provide about 61% employment. Accordingly, governments and donors alike have recognised the important role of the SME sector for overall development. As a result, many government policies are geared towards supporting the SME sector growth through a variety of programs that include tax incentives, regulatory provisions, policy interventions, technical assistance, training and various types of business development services (O'Shea & Stevens, 1998).

2.2.2 SMEs and ICT in South Africa

The ICT sector in South Africa can be divided broadly into the information technology (IT), telecommunications and electronics sub-sectors. For its part, the IT sub-sector in South Africa is dominated by the private sector, predominantly in the form of multinational enterprises. The majority of companies in the IT sub-sector supply either software or services, while comparatively fewer companies provide hardware (SEDA, 2012).

ICT is regarded as a significant contributor to development in South Africa due to its direct influence on the performance of the economy. In line with this, the ICT sector has made a positive contribution to stimulating economic growth and development in the country in recent years. This has been accompanied by a marginal increase in the contribution of the sector to the national GDP. Specifically, between 2005 and 2008, the contribution of the ICT sector to the country's GDP increased from 1.8%to 2% (Gillwald et al., 2012). ICTs can improve efficiency and increase productivity in different ways, including improving efficiency in resource allocation, reducing transaction costs and aiding technical improvement, leading to the outward shifting of the production function.

The role that ICTs play in the broader society is underscored by the 2010 World Bank study that found that for every 10% increase in broadband penetration in emerging markets, there is a 1.38% increase in GDP growth. Therefore, the ability of South Africa to compete in the global economy is dependent, to a large extent, on the state of its ICT sector and, in particular, the country's ability to facilitate and grow the sector to meet its citizens' needs for affordable, accessible broadband. The rapid deployment of fast and affordable broadband infrastructure remains a powerful platform for creating an internationally competitive knowledge economy, improve productivity and expand access to new markets (DoC, 2013).

Although South Africa is better developed and its ICT infrastructure is far more advanced than that of other African countries, Wolf (2001) found that SMEs in South Africa still face similar problems as in other African countries with respect to poor management practices, limited access to technology, limited access to credit facilities and education, unemployment, ICT infrastructure and the role of the SME sector in the slow pace of Internet services. The challenge is to encourage SMEs to move beyond these basic steps and towards eventually integrating ICTs in more sophisticated business applications. This is a significant obstacle for SMEs, especially in developing countries as this would require management and technical skills, as well as investments and organisational changes which they may not be able to afford or for which they may not have ready access to.

Gono, Hariandranath and Özcan (2015) conducted a study on ICT adoption among South African SMEs in the manufacturing and logistics industry. Their study found that the majority of the respondents lacked ICT knowledge and, subsequently required external expertise. This highlights the lack of skills within the workforce (Cant et al., 2015). The study also concluded that SMEs were dependent on their supply chain relationship, which required that they not only maintain these relationships, but also keep up with developments in technology. Similarly, another study conducted amongst small hotel establishments in South Africa stated that the main pressures to adopt ICT

came from various stakeholders, namely customers, suppliers and competitors (Mpofu et al., n.d.). This study also highlights the importance of the owner/manager's support and knowledge of ICT as a key determinant of adoption (Cant et al., 2015).

A 2010 survey conducted by the National Youth Development Agency (NYDA) found that even though the majority of emerging (59%) and established (79%) SMEs have access to the Internet, there is still a large number of SMEs that have no Internet connectivity whatsoever. **Table 1** below shows the percentages of Internet connectivity of South African SMEs. One of the reasons why there is such a high number of SMEs without Internet access is that South Africa is considered one of the most expensive countries in terms of Internet costs and has one of the slowest connectivity speeds (HumanIPO, 2013). South Africa is placed 58th out of 64 countries that were used to compare broadband access versus cost ratio (HumanIPO, 2013).

Table 1: South African SME Internet Connectivity, 2010

	Emerging SMEs	Established SMEs
No Internet connectivity	37%	17%
GPRS connectivity	2%	2%
3G connectivity	6%	3%
ADSL connectivity	51%	74%

Source: Cant, et al. (2015)

The high cost of connectivity and lack of infrastructure is one of the biggest problems in South Africa. According to Herselman (2003), South Africa has developed in an uneven manner; while the urban areas have access to the latest technologies, the rural areas are underdeveloped with little of the infrastructure needed to thrive in the knowledge economy, such as electricity and telephone lines, (Modimogale & Kroeze, 2011). This further highlights the problem of the growing digital divide between developed and developing

countries. As mentioned above, the South African government is aware of the need to participate in the global knowledge economy. It has thus mandated the national telecommunications provider, Telkom to meet its target of making South Africa a connected country while reducing the cost of communication through ICASA (Independent Communications Authority of South Africa) (Modimogale & Kroeze, 2011).

2.2.3 ICT adoption models

According to Kim and Crowston (2011), an individual's ICT adoption and use can be understood in three different stages: pre-adoption, adoption, and post-adoption. **Figure 1** below shows the adoption processes of ICT. At the pre-adoption stage, people may examine a new technology and consider adopting it if they see immediate benefits or specific need. At the adoption stage, they then form an intention and plan to adopt the technology, and they eventually purchase and use it. Finally, at the post-adoption stage, people may either continue to use the technology or abandon it. If they abandon a technology, they may start to examine another technology at the same time in order to substitute their old technology.

Figure 1: ICT Adoption Process, Including Pre-Adoption, Adoption, and Post-Adoption Stages

Pre-Adoption (t1)
- Examine a technology and consider to adopt

Adoption Stage (t1)
- Form an intention to adopt
- Purchase and use

Post-Adoption (t1)
- Continue to use
- Abandon the technology
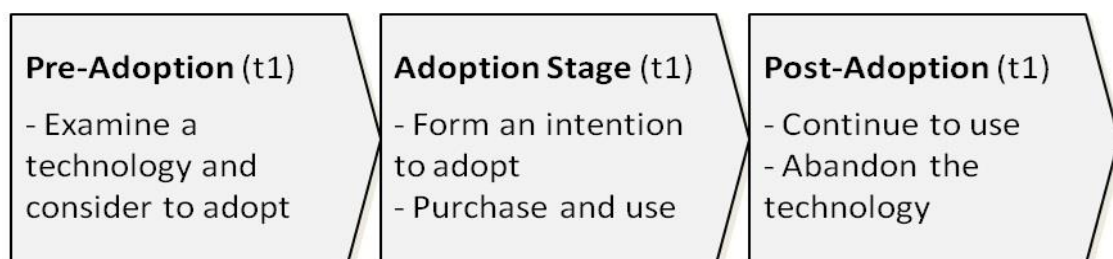
Source: Kim & Crowston, 2011

According to literature, SMEs prefer to adopt simple ICT infrastructure, such as basic Internet services (e-mail and web services), which are more valuable to them on an operational level rather than a strategic level. In turn, this could be potentially interpreted as being in line with Brown and Lockett's (2004) study, which suggests that SMEs are more comfortable with low complexity ICT applications and try to avoid the more complex applications. This is not surprising because SMEs often lack the necessary ICT skills or capacity in their workforce (Spectrum, 1997). Parida et al. (2010) argue that SMEs do not adopt the more advanced ICT services because they are unfeasible or may not suit the simple nature of their specific businesses. In fact, ICT providers used to target large firms as they usually had adequate resources and were willing to pay for more complex ICT services. Hence, their products are often too expensive and unmanageable for SME users.

There are numerous models and theories employed in studying ICT adoption and post-adoption behaviours. Social psychology and its applied theories and models are dominant in this strand of research. These theories and models focus on the intention to adopt and use ICT as a major theoretical foundation. The most influential theories/models looking at ICT adoption can be rooted in the following five: 1) E-adoption model; 2)Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975); 3) Diffusion of Innovations Theory (DOI) (Rogers, 2003); 4) Theory of Planned Behaviour (TPB) (Ajzen, 1991); and 5) Technology Acceptance Model (TAM) (Davis, 1989). These models and authors are all well cited in ICT adoption studies and this study will thus focus on these core models (Runevad & Olofsson, 2014).

Figure 2: E-Adoption Model
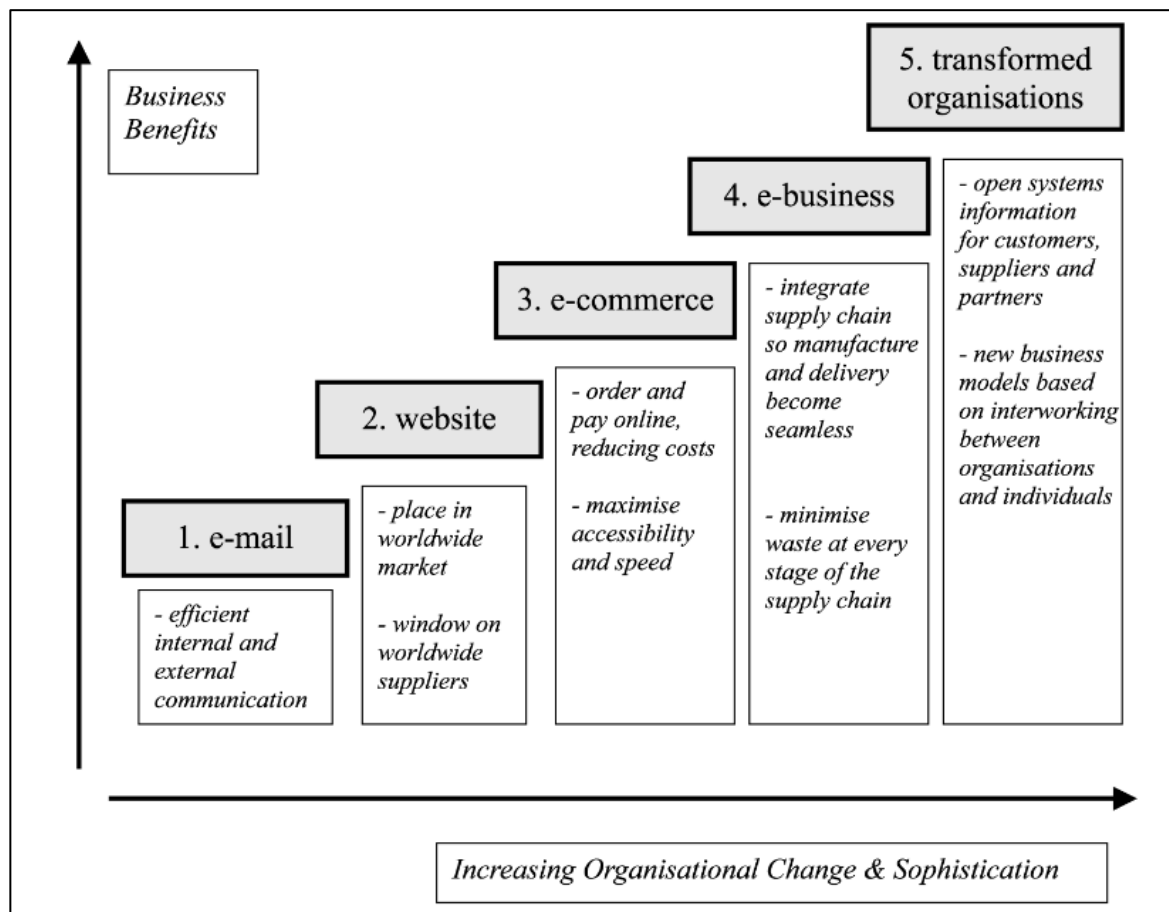
Source: Martin & Matlay, 2001

The 'e-adoption' ladder (DTI, 2001) is preferred by the UK government's Department of Trade and Industry (DTI). Taylor and Murphy (2004) argue that when SME take-up rates of ICT are viewed from a purely technological perspective, engagement with technology is viewed as sequential and progressive. The ladder measures the level of ICT adoption based on two dimensions, namely business benefits and extent of organisational change and sophistication.

The sequence begins with the use of e-mail and websites through e-commerce and e-business, and ends with 'transformed organisations.' The ladder starts at the most basic level which is e-mail, then proceeds to website, e-commerce, e-business and transformed organisation.

1. E-mail: Basic e-mail communication involves communicating with co-workers in the company and receiving/sending e-mails outside the company.

2. Website: Predominantly used for marketing purposes and for suppliers or customers to look for information.

3. E-commerce: Customers are able to order and pay online at all times of the day; this thus indicates higher-level accessibility.

4. E-business: Incorporates a higher level of integration with the company functions together with e-commerce, which involves technical support and other services.

5. Transformed organisations: This highest level of ICT sophistication concerns integration with the firms' business model and applies mainly to companies that use the Internet as a platform for their daily business activities. "The process views firms as starting with the simple use of e-mail for the purpose of text messaging and communication. Further developmental stages build up, step by step, through to the final goal of integrating most if not all internal processes of business through the use of ICT" (Martin & Matlay, 2001).

The e-adoption model offers an explanation of how the process of ICT adoption takes place in small firms. This process views firms as starting with the simple use of e-mail for the purposes of text messaging and communication. Further developmental stages build up gradually through to the final goal of integrating most, if not all, internal processes of a business through the use of ICT (Martin & Matlay, 2001).

This 'ladder' model is driven by the assumption that positive benefits will result from the development of Internet-based operations by existing small firms. Despite previous research that outlined a more complex view of inhibitors and motivators for small business ICT implementation, this assumption continues to drive the process both at company and national levels (Chambers and Parker, 2000).

It is argued that the 'e-adoption' model is problematic because it implies that all SMEs have the need to follow one linear prescribed course, with the further implication that not finishing at the top of the ladder is some kind of failure (Taylor & Murphy, 2004). Moreover, Martin and Matlay (2001) also criticise the assumption in the adoption ladder that all firms subscribe to linear development in ICT and they argue that it fails to distinguish between businesses of various sizes, ethnic origin, and stage of ICT adoption.

Figure 3: Theory of Reasoned Actions
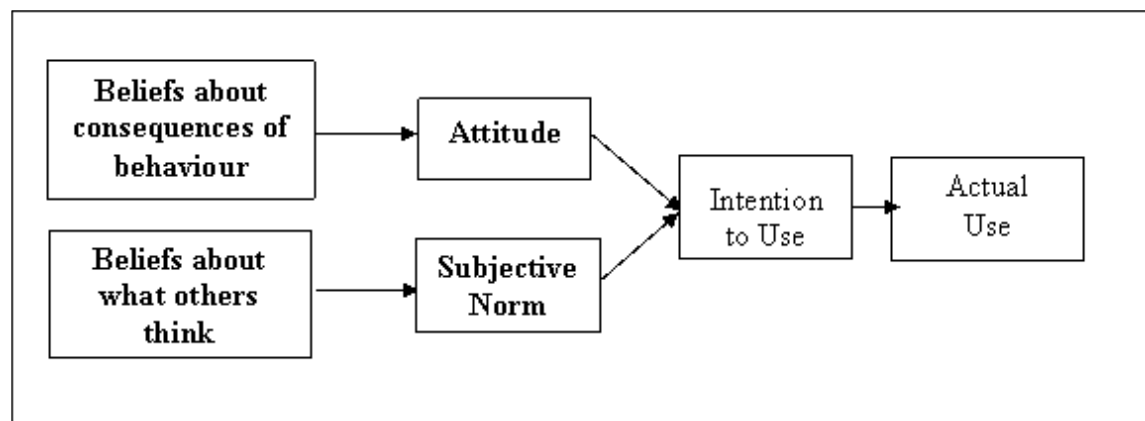
Source: Ajzen & Fishbein, 1980

The Theory of Reasoned Actions (TRA) originates from social psychology and has three general constructs: 1) behavioural intention; 2) attitude; and 3) subjective norms. Fishbein and Ajzen (1980) developed the TRA to define the links between the beliefs, attitudes, norms, intentions, and behaviours of individuals. The theory assumes that a person's behaviour is determined by the person's behavioural intention to perform it, and that the intention itself is determined by the person's attitudes and his or her subjective norms towards the behaviour. In **Figure 3** above one notices the two main aspects of TRA, namely attitude towards behaviour and subjective norms, which lead to intention. Intention is the ultimate motivating factor influencing one's behaviour (Ajzen, 1991).

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In ICT adoption research TRA has been used as a fundamental theoretical framework, and has also been combined with other theories and models. Both attitude and subjective norms were found to be important determinants of peoples' intentions to adopt and use ICTs (Kim & Crowston, 2011). Attitude particularly was found to have a significant influence on the intention to adopt and continue to use ICT. One might have the belief that adopting modern ICT is good for one's professional career because it enhances efficiency and effectiveness. However, it is time consuming to learn and resources are also not always available. Each of these beliefs can be weighted based on one's perception of the merits of those beliefs. Regarding subjective norms, previous studies found that subjective norms influence not only behavioural intention, but also other constructs, including satisfaction, image and perceived usefulness (Shareef et al., 2009).

Figure 4: Technology Acceptance Model (TAM)
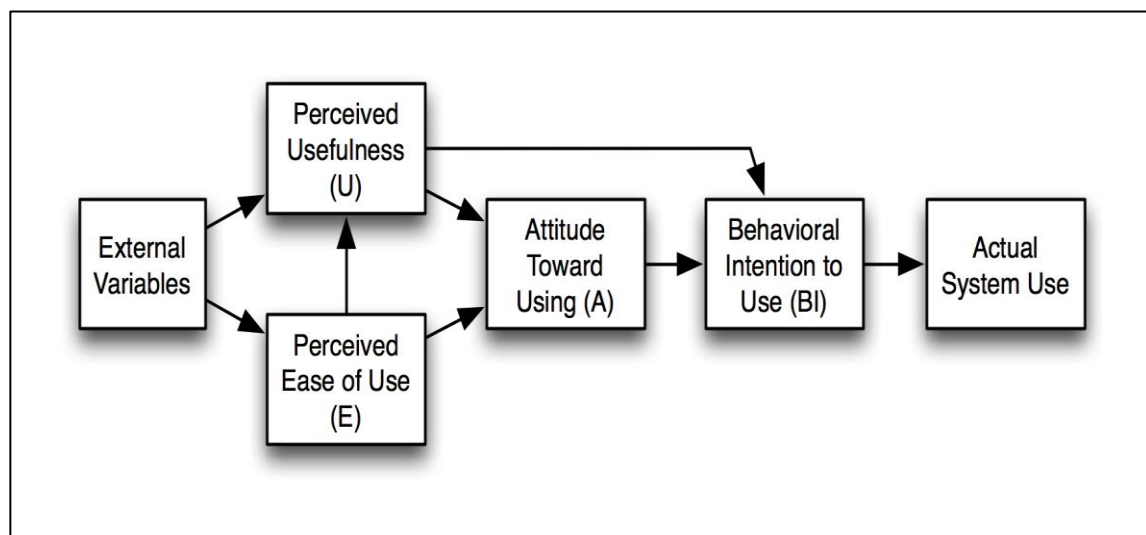
Source: Davis, 1989

First proposed by Davis in 1986, the Technology Acceptance Model (TAM) has been the dominant model in ICT adoption studies. Davis (1989) presented the Technology Acceptance Model (TAM) to explain the determinants of user acceptance of a wide range of technologies. In TAM, Davis identified two theoretical constructs, including perceived usefulness

(PU) and perceived ease of use (PEOU), that affect the intention to use a system.

Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance", and perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). TAM believes that actual technology adoption is determined by intention to use, which is viewed as being jointly determined by the person's attitude towards adopting new technology innovation and perceived usefulness (Djatikusomo, 2014). Hence, perceived usefulness and perceived ease of use are the two determinants that have important relevance for the acceptance of information technology (Bruner & Kumar, 2005; Davis, 1989; Talukder et al., 2008).

Numerous studies have used TAM as their theoretical background for explaining ICT adoption. Scholars already confirmed that PU has a positive relationship with both adoption intention (Davis, 1989) and continuance intention (Agarwal & Karahanna, 2000; Venkatesh, 2000). In post adoption studies, PU has been found to influence satisfaction (Bhattacherjee, 2001; Limayem et al., 2007) and attitude toward the technology (Bhattacherjee & Hikmet, 2008). PEOU has been found to influence both PU and adoption intention (Davis, 1989).

Even though TAM was found to be a valid theoretical framework in studying ICT adoption and use, it has also been criticised for several limitations, including the original model's intended generality, not considering non-organisational setting (Venkatesh & Davis, 2000), overlooking the moderating effects of ICT adoption in various contexts (Sun & Zhang, 2006).

Figure 5: Rogers's Diffusion of Innovation Model

| 2.5% Innovators | Early Adopters 13.5% | Early Majority 34% | Late Majority 34% | Laggards 16% |

Source: Everett Rogers Diffusion of Innovations model
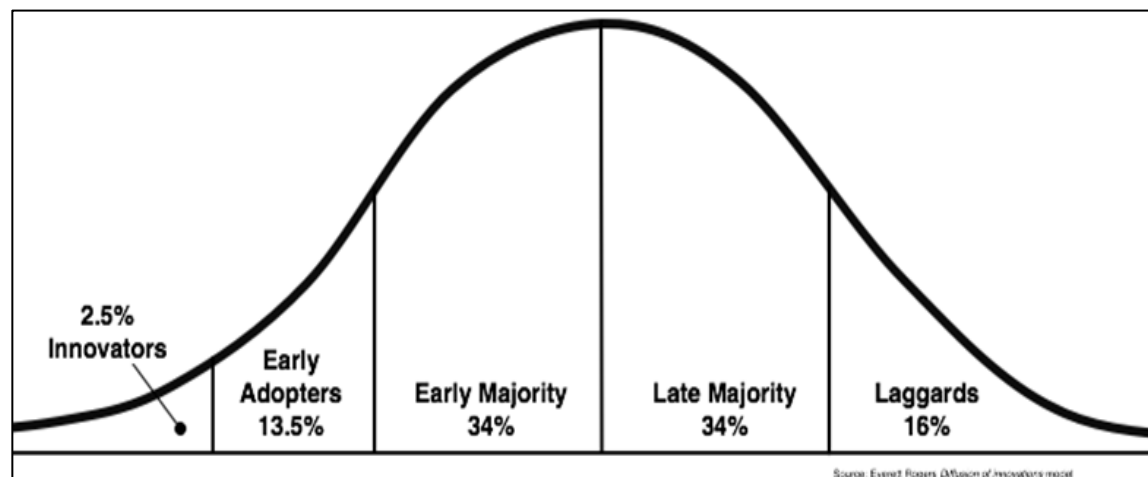
Source: Rogers, 1995

The Innovation Diffusion Theory (IDT) by Rogers (1995), as seen in **Figure 5** above has been used in studying individuals' technology adoption. The main goal of IDT is to understand the adoption of innovation in terms of four elements of diffusion, namely innovation, time, communication channels, and social systems. IDT states that an individual's technology adoption behaviour is determined by their perceptions regarding the relative advantage, compatibility, complexity, trialability, and observability of the innovation, as well as social norms (Rogers, 2003). Based on information filters through the networks – which depend on the nature of the networks – and the roles of its opinion leaders, new innovations are either adopted or rejected. Opinion leaders influence an audience through personal contact while intermediaries, such as change agents and gatekeepers, also contribute to the process of diffusion (Manueli, 2007).

There are a numerous studies that use the IDT as its theoretical framework or combine the IDT with other theories and models to explain ICT adoption and use. The five main constructs of IDT were employed and found to have significant relationships with other factors in ICT adoption research. As an example, relative advantage was shown to have a positive relationship with attitude and relative usage intention, and compatibility was found to influence PU, PEOU, attitude and intention. Similarly, complexity was found to have a

negative relationship with the technology adoption intention (Beatty et al., 2001; Son & Benbasat, 2007). Rogers (1995) further claims that there are five adopter categories, namely innovators, early adopters, early majority, late majority, and laggards. Interestingly, the five categories follow a standard deviation curve where very few innovators adopt at the beginning (2.5%), with early adopters constituting 13.5%, the early majority constituting 34%, the late majority another 34%, and the laggards making up the final 16% (Manueli, 2007).

Figure 6: Theory of Planned Behaviour
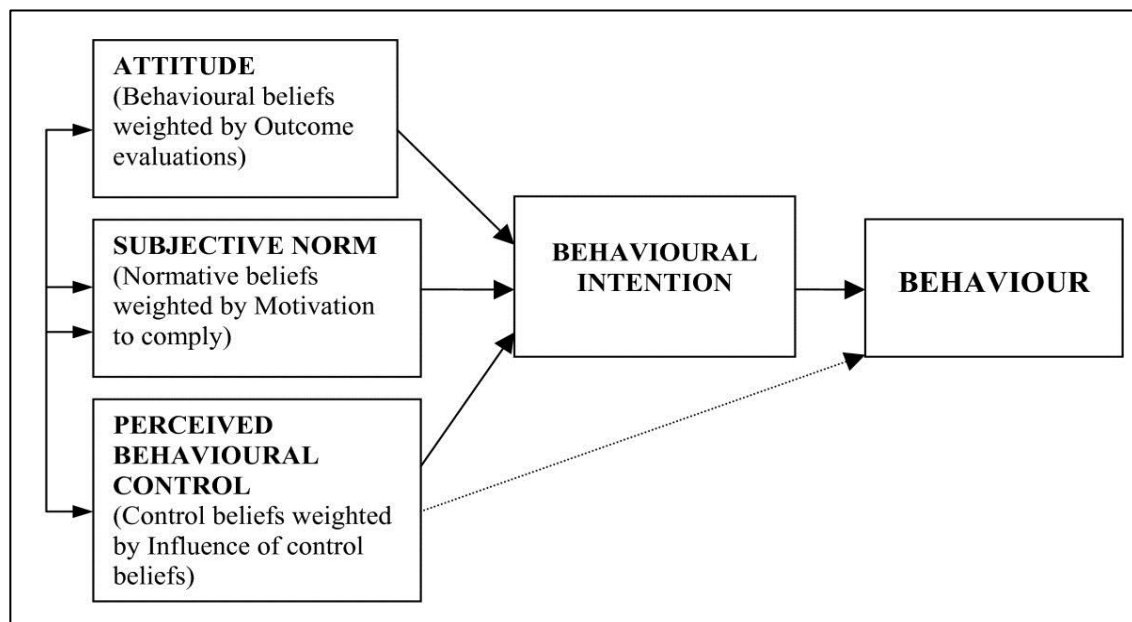
Source: Ajzen, 1991

Similar to TRA, the Theory of Planned Behaviour (TPB) is a well-established social psychology theory which believes that specific salient beliefs influence behavioural intentions and subsequent behaviour (Ajzen, 1991). TPB added another construct to TRA called perceived behavioural control (PBC). Perceived behavioural control refers to the perception of control over the performance of a given behaviour. Numerous studies in ICT adoption research have used TPB as their theoretical framework (Hsu & Chiu, 2004; Liao et al., 2007). Similar to studies using TRA, these studies also found

significant relationships between attitude, subjective norms, perceived behavioural control and behavioural intention. PBC, as an additional construct in TPB, shed light on the importance of the perceived difficulty of the behaviour and the person's perceived ability to act out the behaviour. A good number of studies found that PBC directly influences technology adoption intention (Chau & Hu, 2001; Wu & Chen, 2005) and continuance usage intention (Hsu et al., 2006; Liao et al., 2007).

Mathieson (1991), while trying to understand people's intention to use technology, compared the TAM with the TPB. From this, three main differences were identified: 1) TAM supposes that usefulness and ease of use are the main influences on user decisions, while TPB primarily explores beliefs that are specific to each situation and proposes that some beliefs may be generalised to other contexts while some may not; 2) unlike TPB, the TAM is not as rigourous in determining social variables; and 3) TPB has a stronger treatment of behavioural control, whereas TAM only focuses on ease of use in regards to technology. Mathieson (1991) further suggests that while TAM is useful for gathering general information about people's perception of a system, TPB can provide detailed information regarding each of its components that might relate to a specific group of people.

2.2.4 Value added through ICT adoption

As previously mentioned, ICT can be seen primarily as digital technologies used to collect, organise, store, process and communicate information within and external to an organisation. ICT can fulfil a number of business needs, such as strategic, operational or marketing needs, or a combination of these (Ritchie & Brindley, 2005).

In the current knowledge economy, the ability of firms to create, accumulate and disseminate knowledge represents a core function. Research has shown that ICT can serve as a catalyst for effectively performing this function as it enables firms to codify knowledge into a digital form and easily transmit it

anywhere around the world. Firms with access to ICT and with the capacity to implement it are able to use this for transmitting and/or processing information, which includes a wide array of technology, ranging from database programs to local area networks (Matlay & Addis, 2003). ICT has also speeded up the pace of globalisation and increased the complexity of business practices, because firms today not only need to be familiar with their local contexts but also with global developments. In order to compete in the knowledge economy with these developments, SMEs need a strong ICT skills base that lends itself to innovation and is ready to adapt to given changes. Hence, ICT plays a fundamental role in reducing the uncertainties prevailing in the economy through systems for processing and spreading information more freely (Franco et al., 2011). ICT also provides access to information through the Internet and, in general SMEs that effectively employ ICT have a greater probability of becoming commercially successful (Taylor & Murphy, 2004).

ICTs have the potential to develop SMEs through its effective use and better integration into business processes, while also assisting SMEs to make more efficient decisions relevant to their performance. Furthermore, ICTs have the potential to generate a step change among SMEs, making them more competitive, innovative and able to generate growth (Barba-Sanchez et al., 2007).

The adoption of ICTs improves information and knowledge management in the firm, reduces transactions costs and increases the speed of transactions for both business-to-business (B2B) and business-to-consumer (B2C) transactions. In addition, ICTs are effective tools for improving external communications and quality of services for established and new customers (Lukács, 2005). ICTs enable SMEs to have access to robust business information that leads to organisational effectiveness (Irani, 2002). These ICT tools are no longer seen as a technical 'service', but as a critical resource to enhance the competitiveness of SMEs in any business environment (Kohli & Devaraj, 2004; Tumolo, 2001).

- **ICT and SME competitiveness**

Compared to larger enterprises, flexibility is seen to be a significant source of competitiveness for SMEs. The use of ICT can increase the competitiveness of SMEs as they enable the creation of more flexible links with business partners because of faster and more reliable communication channels. Conversely however, ICTs can help larger organisations to increase their flexibility through a restructuring of the business, which will enable them to adapt more readily to changing conditions. This may mean that the competitive advantage of SMEs could also decline (Matambalya & Wolf, 2001).

In general, SMEs rely much more on informal information systems than larger enterprises do. To get the relevant information that is needed for a rational decision is often not cheap, especially as SMEs often have a single decision maker – the owner/manager – whose personal resources are restricted. However, SMEs have the advantage of smaller internal coordination costs as decisions are made by or fewer people (Blili & Raymond, 1993).

External transaction costs are associated with the initiation, negotiation and enforcement of contracts. The Internet can help especially to screen the enterprises' environments for relevant information and, in this way, get information about sellers and customers that were previously out of reach (Müller-Falcke, 2001). However, for the actual delivery of goods and the transmission of payments, other infrastructure like transport and a reliable banking system have to be in place.

With the use of ICTs, transaction costs can be lowered and, as a result, the economies of scale in exporting can be reduced. This allows SMEs to expand regionally and internationally, beyond local markets. However, SMEs that are located in rural areas usually serve local niche markets and are thus protected against competition from bigger enterprises because of high transport and communication costs. ICTs might, therefore, also increase competition for these enterprises so they either have to become more productive or close down. Moreover, Apulu and Latham (2010) claim that ICT enables customers

to give immediate feedback that allow companies to respond expeditiously to customers' demands and recognise new market niches. Thus, ICT can bring about change in organisations and make them more competitive and innovative, and assist in increasing organisational growth.

- **The impact of ICT on economic performance**

Information asymmetries are one of the prime causes of high transaction costs, uncertainty and ultimately market failure. A reduction in the information gap can reduce the ability of the better informed to extract rents from the less informed, be it buyers or sellers of goods. As SMEs usually have less access to information, this effect might help to reduce disadvantages and inequality. An increase in access to information will also create new opportunities and therefore enhance the efficiency of resource allocation (Akerlof, 1970). On a macro level, this will then lead to faster growth and diversification of the economy. In this context, the key role of ICTs is that they may be used to acquire and process information and reduce uncertainty (Matambalya & Wolf, 2001).

ICTs can serve as information channels because they are able to support the decoupling of information from its physical repository, which can be argued to be the truly revolutionary aspect of these technologies (Evans & Wurster, 1997). This allows the immediate transmission of large volumes of information and permits communication independent of the physical movement of individuals. This effect allows users access to large amounts of information and ideas, which can potentially generate large content-related externalities that will improve innovation capacity and diffusion. The use of ICT networks is also non-rival in nature and an increase in network size generates network externalities (Matambalya & Wolf, 2001).

Ollo-Lopez and Aramendia-Muneta (2012) state that ICT adoption seems to have a positive effect on productivity, whether it be directly or indirectly, depending on the sectors, and have great potential to support sustainable development. Furthermore, the use of e-mail, e-commerce, and social media networks have significantly cut physical transportation needs involved in

sending mail, banking, advertising and buying goods (Manochehri et al., 2012). However, it is important to recognize that there is still a need for longer term investments in ICT because the positive impact of ICT occurs only after a period of adoption. (Consoli, 2012; Bayo-Moriones et al., 2013).

According to Müller-Falcke (2001) Indian manufacturing SMEs which make use of more advanced forms of ICTs have, on average, a higher labour productivity and a higher growth rate. In a survey of 59 Indian manufacturing SMEs mainly employing less than 50 people, Lal (1996) found that they experienced higher profit margins, skill intensity and export and import intensities for firms using IT. However, it is not the investment in the technology alone, but the combination of technology investment and other technologies, as well as relevant skills, that makes ICT work (Matambalya & Wolf, 2001).

As seen in **Figure 7,** Consoli (2012) analysed the literature on ICT impact on companies and identified and categorised the main impacts into four groups: performance, growth, expansion and new products. Each group consists of several dimensions, such as efficiency, productivity and product quality.

Figure 7: Impact of ICT on Organisations
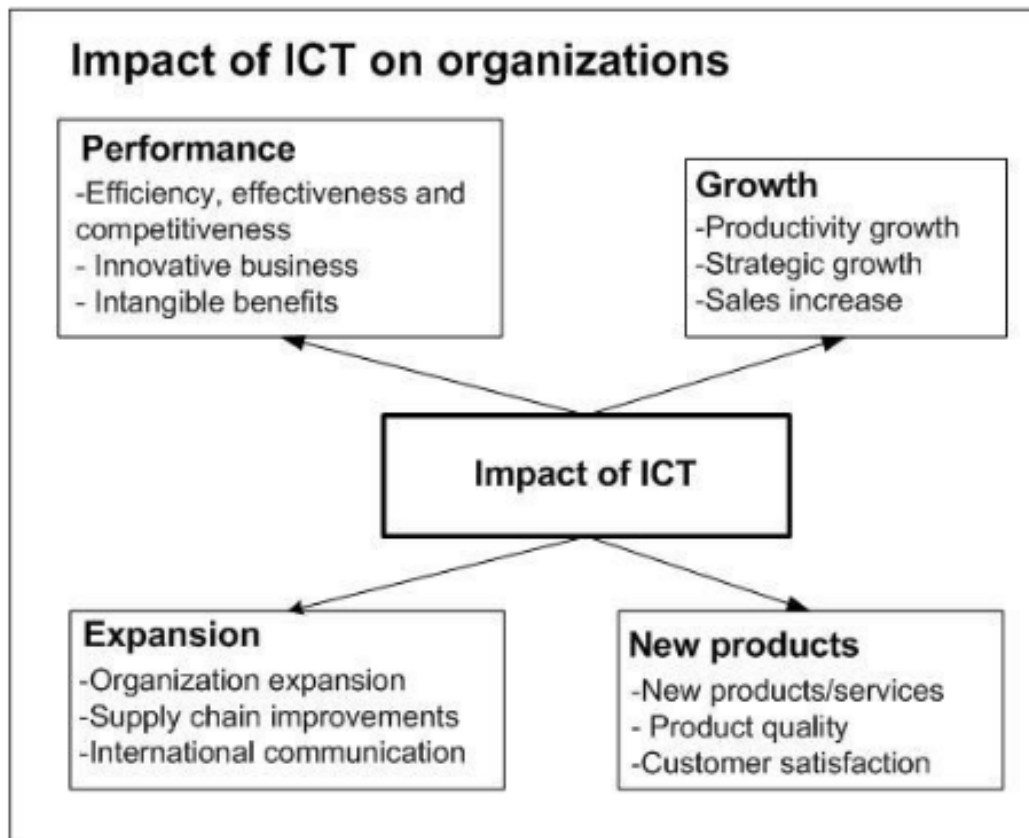
Source: Consoli, 2012

Michael Porter describes value chains and Information Technology's effect on competitive advantage from the value chain model's perspective (Porter, 1985). According to him, introducing ICT into the value chain changes the way it operates and has a direct influence on the linkages between the various functional units of an organisation. This relationship between ICT and an organisation's value chain, with ICT having the power to refine it and the linkages within it, shows that ICT plays a keyl role in creating value for an organisation (Porter & Millar, 1985). **Figure 8** below uses Porter's value chain model to summarise various ways that ICT can benefit a firm.

Figure 8: Porter's Value Chain

Inbound Logistics	Operations/ Manufacturing	Outbound Logistics	Marketing and Sales	After-sale Service	
• Cheaper and faster communication with suppliers through Supply Chain Management	• Improve Inventory Management systems • Enterprise Resource Planning software • Rapid Prototyping and Manufacturing programmes	• Easier to link to global supply chains and outsourcing opportunities	• e-Commerce • e-Marketing through websites	• Customer Relationship Management software	Margins

Firm Infrastructure (Finance, Planning)
- Better accounting and financial management practices
- Improved communication between different departments through the intranet
- Better grasp of business trends and market prices through easier access to information
- Use models to enhance business planning capabilities

Human Resource Management
- e-Learning for employee training

Technology Development
- Better Knowledge Management within the firm
- Integrate different software platforms through Enterprise Application Integration

Procurement
- Use e-procurement for cheaper and faster communication with suppliers

Source: Kotelnikov, 2007

Overall, as shown in the above literature, ICT can provide a number of benefits across a wide range of intra- and inter-firm business operations and transactions. ICT applications can contribute to improved information and knowledge management inside the firm, can reduce transaction costs and can increase the speed and reliability of transactions for both B2B and B2C transactions. In addition, they are effective tools for improving external communications and quality of services for established and new customers (OECD, 2004). It is desirable that SMEs are motivated to adopt new

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technologies, to implement them strategically, while also creating innovative products more competitively. This is dependent on SMEs having a conducive environment in which to develop and prosper, form a skilled workforce and strive for economic growth (Barba-Sánchez et al., 2007).

2.2.5 Barriers to ICT adoption by SMEs

SMEs in South Africa face critical barriers to ICT adoption and use. Some of the key barriers include ICT costs being too expensive, lack of finance, lack of awareness about the benefits of ICT adoption and use, low skills levels, security concerns and ICT applications not tailored to the way SMEs do business (Ismail et al., 2011; Esselaar et al., (2007).

According to Kapurubandara and Lawson (2008), the barriers for SMEs in using ICT can be generally categorised into internal and external barriers as seen in **Figure 9** below.

Figure 9: Barriers to ICT Adoption
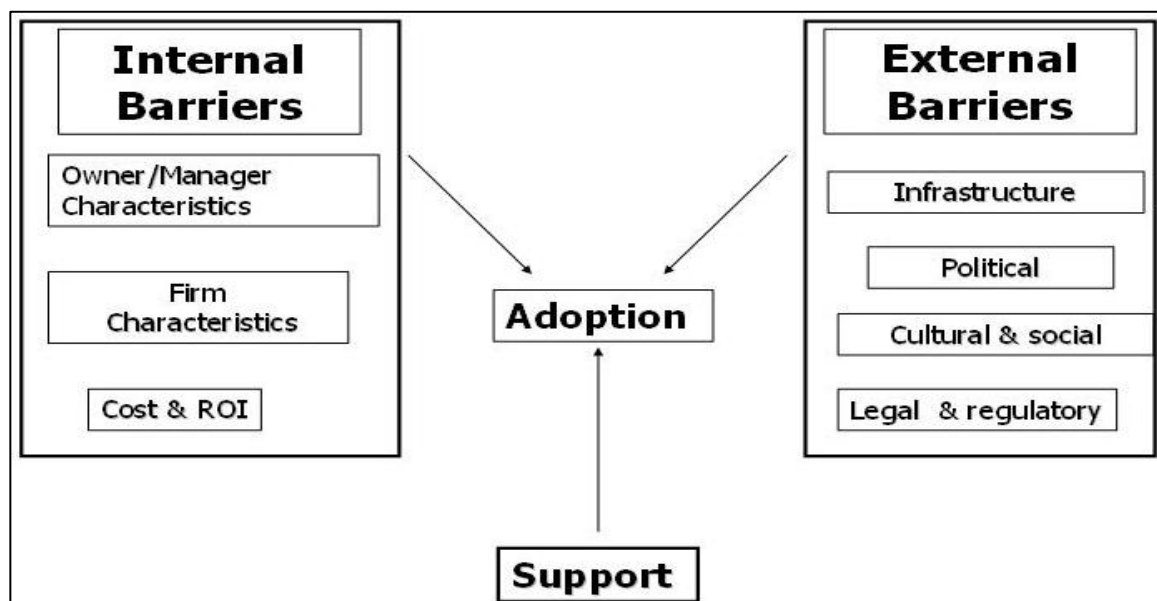
Source: Kapurubandara & Lawson, 2008

Internal barriers: These barriers refer to challenges within the business where the SME still has the ability to change internal factors within the organisation. Some examples include lack of time or resources, and lack of awareness on the part of the owner/manager. Internal barriers can be further categorised into owner/manager) barriers, organisational barriers, and cost and return on investment (Kapurubandara, 2009).

External barriers: These are barriers that cannot be resolved by the SME. They have no control over these and are compelled to work within the constraints, for example inadequate telecommunication infrastructure, inadequate service providers, or government policy. Some of these barriers can be addressed by SMEs working together. This can be done irrespective of the industry sector to form clusters with the aim of sharing expenses, resources and facilities. Alternatively, SMEs from the same industry sector can work together to address certain external barriers where governmental intervention may be required (Kapurubandara & Lawson, 2008).

Ngwenyama and Morawczynski (2007) argue that it is assumed that ICT will bring about significant benefits, but not all environments are the same. The issues affecting the successful implementation or adoption of ICT are both socio-economic and technological. A major barrier in South Africa is that many SMEs are generally seen as disadvantaged in comparison to larger more established businesses in that they are likely to have limited availability of resources in terms of time, money and expertise. The lingering challenge in South Africa continues to be the expensive connectivity costs in conjunction with a lack of infrastructure, which supports emerging technologies. According to Vosloo (2005), South Africa due to historical context has been developed in a disparate way, where the urban areas have high-end technologies, while the rural areas remain underdeveloped and lack even basic infrastructures, as well as resources needed to succeed in a knowledge economy.

From the literature reviewed above the following significant internal and external barriers preventing SMEs from adopting ICT exist:

- **Infrastructure**

In order to adopt ICT effectively, basic infrastructure such as electricity, affordable bandwidth and government structures must be in place. Many studies have emphasised that deteriorating rural infrastructure, poor education, ineffective telecommunication links and poor governance are major challenges facing developing nations (Bagchi & Udo, 2007; Gupta et al., 2008). While South Africa is considered to have much better infrastructure than other African nations, underdeveloped infrastructure in its rural areas still pose major impediments to Internet adoption (Roycrofta & Anantho, 2003). Thlabela et al. (2006) argue that improvements in the level of access to ICT will only be achieved when issues relating to the cost of telecommunications and the availability of ICT infrastructure are adequately addressed.

- **ICT unsuitable for the type of business**

A significant reason for SMEs not using ICT for business purposes is related to the perception that it does not suite the nature and needs of their specific business (Mehrtens et al., 2001). The view that ICT is not suitable for the business holds strong implications for SMEs aspiring to adopt ICT because they will not take advantage of theses technologies unless these benefits justify the need for establishing and maintaining a more advanced ICT-based system. Thus, such unfavourable perceptions about the use of ICT can be regarded as a justifiable reason (or barrier) for many SMEs to not engage in e-business activities. A recent survey of SMEs with fewer than 250 employees in 19 European countries supports this position, showing that around 40% do not use the Internet for selling because they are of the opinion that ICT applications and e-commerce does not suit their type of business and/or products (OECD, 2002).

- **Absence of knowledge about the use of ICT**

The lack of knowledge about the potential benefits of ICT and strategies to support SMEs in achieving their business objectives is often another significant barrier to ICT adoption. SMEs face the challenge that they are, often, owner managed and the owner makes all or most of the decisions about the business. Unfortunately the owner/manager's limitations or lack of knowledge become limitations of the business. This barrier can be classified as a strategic level problem. ICT needs to be considered a key player for the SME in reaching its goals and this needs to be promoted by senior leadership (Modimogale & Kroeze, 2011).

For innovations and technology to be used effectively, users must be educated or trained and should possess the relevant skills. In their study of e-commerce adoption in developing countries, Kapurubandara and Lawson (2008) argue that the lack of skills and knowledge of technologies, as well as the lack of understanding of the benefits they provide and low levels of computer literacy are major impediments to the adoption and use of ICT. Mutula and Van Brakel (2006) reported that SMEs in Botswana were not exploiting the potential of technologies due to a lack of skills. Orford et al. (2003) also claim that the lack of IT, poor planning and high illiteracy levels are common problems facing the SME sector in South Africa.

- **Insufficient skills**

As mentioned above, the owner is often the centre of the business, making all or most of the decisions in the SME, so the adoption of ICT by the small business depends on the owner's ICT skills, personality and attitude towards technology. The IT skills problem forms part of the bigger problem of a shortage of specialists in ICT in Africa. The South African government has set up Skills Education Training Authority organisations (SETAs) in an attempt to increase ICT skills (Modimogale & Kroeze, 2011). However, the owner/manager's attitude towards ICT and its value still need to change, and each SME needs expertise to work with (Mutula & Brakel, 2007). The owner or manager of a small firm has significant influence on the adoption of ICT. In

Parida's (2010) study of three technology-based small firms, it was found that the perception of the owner/manager had significant impacts on how the firm viewed the role of ICT. If the SME owner was unfamiliar with operating a computer and held the belief that ICT is only for larger firms, they were unlikely to get involved in ICT-related activities. Thus, even when they possessed the necessary financial resources needed to integrate ICT into their business, they often failed to recognise the need to use ICT in their company. However, when owners had a positive view about ICT, the main barrier for ICT adoption was due to a lack of skilled employees. Firms that want to adopt ICT need to have employees with a reasonable amount of knowledge regarding the use of technology. Therefore, if SMEs have well-trained ICT staff, they are more likely to adopt and use ICT as a competitive tool. Furthermore, Manueli et al. (2007) suggests that business action is driven by the key decision-makers responsible for defining appropriate ICT goals, identifying critical ICT business needs and allocating financial resources to facilitate ICT adoption. In addition, Gray (2006) maintain that SME owners with appropriate qualifications and ICT skills are more growth-oriented while those without these prerequisite characteristics are more likely to be growth averse.

- **High cost**

A common barrier, ICT applications are seen to be costly by SMEs so they often do not have a budget for it. ICT is often associated with large costs and exceeding budgets (Modimogale & Kroeze, 2011). Another problem with regard to the cost of ICT is that SMEs often invest in unnecessarily big solutions due to sale pitches, hype of specific products or market patterns without considering their practical needs. Often SMEs could have purchased a less complicated, smaller package or programme to meet their needs, and thus paid less. Technology can be expensive or cheap, depending on which technology platforms are chosen. Once again, understanding the role of ICT will make it easier for the business to achieve its goal (Modimogale & Kroeze, 2011). Dixon et al. (2012) concluded that the cost of technology is a definng influencing factor in the adoption and use of technology by many SMEs. The

authors argue that smaller businesses will less likely adopt and use technology when its initial set-up cost is high. Matlay and Weathead (2013) also recognised that many SMEs in Africa often have great difficulty when outsourcing for financial support. Therefore, adoption and use of new technologies may be considered too expensive and a luxury by these enterprises because of their lack of financial support. According to Paul and Pascale (2013), many SMEs in Africa face specific challenges in the formulation of innovation strategies because of their limited range of technological competencies and lack of financial resources. Pavon and Brown (2010) also argue that the economic development in a region impacts on accessibility and exposure to technologies, which, in turn, influences their adoption and diffusion. In South Africa, for example, not many people use the Internet partly because of the high telecommunication costs and poor communication infrastructure (Gillwald et al., 2004).

- **Constantly evolving ICT environment**

The ICT landscape is constantly and rapidly changing, so there needs to be continuous learning and updating of technologies by all involved. With technology evolving – getting faster, smaller, and more powerful – it is necessary that SMEs keep abreast of these trends. There are two issues here that pose challenges to the SME. On the one hand, it is necessary that they monitor the kinds of technologies that their clients are using and try to make sure that they are on par in order to serve them. On the other hand, however the SMEs do not need to change every time there is a change in technology; this depends on their focus area and their requirements. The ICT strategy of the SME needs to take into consideration that technology changes at a rapid rate, that the different technologies need to be monitored as they evolve, and that the staff need to be excited and skilled enough to have an interest in the changes as they unfold(Modimogale & Kroeze, 2011).

Based on the above literature reviewed, the numerous barriers to ICT adoption unique to SMEs are summarised in **Table 2** below.

Table 2: Barriers to ICT adoption

Barriers	Source
Lack of resources	Chatzoglou &Vraimaki, 2010; Kabanda, 2001; Kahn et al., 2012, Miller & Garnsey, 2000; Mutula & Van Brakel, 2007; Nguyen, 2009; Reimenschneider et al., 2003; Thomas et al., 2004
Political and social barriers	Kapurubandara & Lawson (2007)
Lack of skills	Esselaar et al., 2006; Kahn et al., 2012; Kapurubandara & Lawson, 2007; Ladzani & Van Vuuren, 2002; Miller & Garnsey, 2000; Modimogale & Kroeze, 2011; Mutula & Van Brakel, 2007; Nguyen, 2009
Effective leadership, and management	Uddin, 2005;Kahn et al., 2012; Spencer et al., 2012; Manueli et al., 2007; Miller & Garnsey, 2000
Security risks; Untrustworthy service providers	AlAwadhi & Morris, 2008; Cohen et al., 2013; Gatautis & Vitkauskaite, 2009; Kapurubandara & Lawson, 2007; Wamuyu & Maharaj, 2011
Lack of infrastructure	Kapurubandara & Lawson, 2007;Esselaar et al., 2006; Kahn et al., 2012; Gillwald et al., 2004; Nguyen, 2009; Ramani et al., 2012; Suri, 2011; Wamuyu & Maharaj, 2011
Legal barriers	AlAwadhi & Morris, 2008; Kahn et al., 2012; Kapurubandara & Lawson, 2007
Financial constraints, high costs	Dixon et al., 2012; Esselaar et al., 2006; Kahn et al., 2012; Ladzani & Van Vuuren, 2002; Ndubisi & Kahraman, 2005; Donner &Escobari, 2010; Nguyen, 2009; Ramani et al., 2012; Thomas et al., 2004; Wamuyu & Maharaj, 2011

Lack of knowledge	AlAwadhi & Morris, 2008; Esselaar et al., 2006; Kabanda, 2001; Kapurubandara & Lawson, 2008; Modimogale & Kroeze, 2011; Ndubisi & Kahraman, 2005; Orford et al., 2003; Ramani et al., 2012
No need for ICT; unsuitable for business	Esselaar et al., 2006; Mehrtens et al., 2001
Performance risk	Wamuyu & Maharaj, 2011
Changing ICT landscape	Modimogale & Kroeze, 2011

Source: Own

2.3　First sub-problem

The first sub-problem looks to understand the existing adoption and use of ICT by SMEs.

2.4　Second sub-problem

The second sub-problem is to determine the barriers to ICT adoption and use.

2.5　Third sub-problem

The third sub-problem is to determine the perceived value obtained from the use of ICT in South African SMEs.

2.6   Conclusion of literature review

In this chapter an in depth review was undertaken on the various literature available on SMEs, ICT adoption models, ICT value, and barriers to ICT adoption. To better provide SMEs with information on the benefits of ICT adoption, it is imperative to understand existing research on ICT value and barriers to ICT adoption. The literature showed a number of significant barriers to ICT use and adoption in organisations, specifically SMEs. However, through further analysis of the literature it is clear that although ICT adoption has been explored quite extensively in recent research, in Africa and other developing economies such work is still limited. While there have been significant improvements in the ICT sector in Africa, there is still much to be desired and SMEs still face the brunt of poor infrastructure and limited support structures.

In cross border studies of growth that mostly include developed countries, the availability of telecommunications infrastructure is often found to contribute significantly to GDP growth along with common indicators such as education. This implies that if the necessary investment is made in ICT infrastructure and complementary factors at the same time, markedly higher growth rates can be achieved (World Bank, 1998).

2.6.1   Hypothesis 1

ICTs are perceived by SMEs to add value to their businesses.

2.6.2   Hypothesis 2

Perceived value of ICT has a positive effect on its adoption and use by SMEs.

2.6.3 Hypothesis 3

Most SMEs make use of general-use ICTs.

2.6.4 Hypothesis 4

External factors are the greatest barriers to ICT adoption amongst SMEs.

2.6.5 Hypothesis 5

Internal factors are the greatest barriers to ICT adoption amongst SMEs.

2.6.6 Hypothesis 6

Owners/managers with a higher education level have a higher ICT adoption rate within their business.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter discusses the methodology used to conduct this research. Firstly the literature on quantitative research will be discussed briefly, followed by a review of the research design and research instrument that was used in this study. Issues of data collection and analysis in relation to this study will be provided, followed by a discussion on the validity and reliability of this research.

3.1   Research methodology/paradigm

The choice of research methodology is influenced by the researcher's theoretical perspective and also his/her attitude towards the ways in which the data will be used (Gray, 2004). For this research, a quantitative approach is more suitable in order to achieve statistical significance from the survey analysis and reach the objectives of this research, which is finding out the barriers to ICT adoption amongst South African small and medium sized enterprises.

Creswell and Plano Clark (2011), state that quantitative research is a mode of inquiry often used for deductive research, when the goal is to test theories or hypotheses, gather descriptive information, or examine relationships amongst variables. These variables are measured and yield numeric data that can be analysed statistically. This research is positivist in nature in that a quantitative survey will be administered to gain an objective understanding of the barriers to ICT adoption amongst SMEs in South Africa. Positivism is based on the view that science is the only foundation for true knowledge (Wagner et al., 2012). The positivist ontology puts forth that the world is external and that there is a single objective reality to any research phenomenon or situation, regardless of the researcher's perspective or belief (Hudson & Ozanne, 1988). Positivist researchers remain detached from the participants of the research by creating a distance, which is important for remaining emotionally

neutral and also to ensure that clear distinctions are made between reason and emotion (Carson et al., 2001). Furthermore, within the positivism paradigm, the function of a research study is its ability to "predict results, test theory or find the strength of relationships between variables" (Wagner et al., 2012).

3.2   Research design

This research is empirical in nature and is based on quantitative data collection, which was obtained by means of a questionnaire distributed to 250 SMEs. The sample includes SMEs from the manufacturing sector and access was be obtained via the Small Enterprise Development Agency *(Seda) and Department of Trade and Industry (DTI*) contact bases, as well as online sources and search engines. In this study, the dependent variable was ICT adoption, and the independent variables were the various barriers to such adoption.

Only owners or managers of the SMEs were chosen as respondents of this study because they manage or oversee the entire operation of their firms and are therefore in better positions to understand the current situation and future trends of their enterprises.

An exploratory research approach was adopted, as the study was aimed at investigating SMEs and providing significant information about SME's usage of ICTs in their daily activities and long-term strategies.   The research is cross-sectional due to time constraints.

3.3   Population and sample

3.3.1 Population

The population for this study is all manufacturing SME owners and managers in Gauteng, South Africa.

3.3.2 Sample and sampling method

The target sample is 250 SMEs from the manufacturing sector in Gauteng, South Africa. Probability sampling and simple random samples were used to make sure that each SME has an equal chance or probability of selection.

The type of sample investigated was owners or managers of South African SMEs. There was an expected sample size of 250 potential respondents. The research sample was selected based on the following criteria:

- **Sector:** Data for this study was collected from SMEs in only the manufacturing sector in South Africa. This specific sector was selected to provide a more contained sample and is based on it being a high growth potential sector in South Africa.
- **South African SME:** A SME was defined to be a firm with less than 250 employees. The sample for the study consisted of SMEs from the Gauteng region within South Africa.
- **Area:** SMEs from urban areas as well as rural areas formed part of the sample; this was to gain insights on the differences between ICT use and perception in these two categories.

3.4 Research instrument

The research instrument used in this study is based on questionnaires created, tested and validated by Ismail, Jeffrey and Van Belle (2011) looking at ICT usage amongst SMEs. The questionnaire consists of a five-point Likert scale for use by respondents, which indicates their response to each of the ICT relevant questions. The response options are: *Strongly Disagree, Disagree, Neutral, Agree* and *Strongly Agree.* All questions needed to be answered in order for the questionnaire to be taken into consideration for this study.

The instrument consisted of four main sections, which includes the general profile of the firm; Information and Communication Technologies in use; perceived value added by ICTs; and barriers to ICT use.

Based on the literature review and results of the pilot study (see section below) the study looked to modify and replicate this questionnaire for the context of South African SMEs. See **Appendix A** for the questionnaire that was distributed to the sample of identified SMEs.

3.4.1 The pilot study

A pilot study was conducted prior to the distribution of the questionnaire to a sample of 20 SMEs within the manufacturing sector to test reliability and help refine the research instrument. Certain constructs were included in the questionnaire following the pilot study, namely options including Open Source Software; Mobile Payment System; Document Management Software (DMS); and Inventory Management Software.

The pilot study was useful in identifying problems with sequence, layout, grammar, punctuation of the questions and questionnaire length. Following the pilot study, some questions had to be reworded to improve their clarity and purpose.

3.5   Procedure for data collection

Empirical evidence of how SMEs adopt and use ICT will be gathered on the basis of firm size, sector and other pertinent characteristics that help provide richer pictures of ICT adoption and use. The data for this research was gathered by means of the online survey tool known as Qualtrics. An electronic survey link was e-mailed to the owners and managers of the selected firms with a cover letter, and the respondents were requested to complete and return the questionnaire. Regular follow-up emails were sent to ensure that participants completed the questionnaire.

3.6 Data analysis and interpretation

The data was analysed through a variety of statistical techniques: descriptive statistics and multivariate analysis. The hypotheses were tested using both descriptive and multivariate techniques, such as correlation and regression analysis.

Quantitative data from respondents of the questionnaire was cleaned and coded in Microsoft Excel. Thereafter the analysis was done using R statistical software. The data was analysed by using descriptive statistics, as that allowed the researcher relevant interpretations and discussions about the topic under study. This descriptive analysis included mean, standard deviation, frequencies and percentages. The results obtained were presented in tables, charts and graphs where practical to do so. For the multivariate statistics, a logistic regression analysis was used to evaluate factors influencing ICT adoption choices in the SME sector. A correlation analysis was also used to evaluate the relationship between owner/manager education levels and ICT adoption. Furthermore, a correlation analysis was conducted to assess the perceived value of ICT and its adoption within the SME sampled. Data analysis methods per hypothesis are described below.

Hypotheses	Analysis
H1: ICTs are perceived by SMEs to add value to their business **H2:** Perceived value of ICT has a positive effect on its adoption and use	**Quantitative:** • Quantitative data from respondents of the survey will be documented, coded and processed with Statistical Analysis Software (SAS). • **Descriptive analysis** will be used to assess SME's perception of the value of ICT for their business. • **Correlation analysis** will be used to assess the relationship between

by SMEs	perceived value of ICT and its adoption within the SME.
H3: Most SMEs make use of general-use ICTs	**Quantitative:** • Data from respondents of the survey will be documented, coded and processed with Statistical Analysis Software (SAS). • The data will be analysed using **descriptive statistics**, and will include mean, standard deviation, frequencies and percentages. • Will be used to elicit information about the ICT adoption patterns of the respondents.
H4: External factors are the greatest barriers to ICT adoption amongst SMEs **H5:** Internal factors are the greatest barriers to ICT adoption amongst SMEs **H6:** Owners/managers with a higher education level have a higher ICT adoption rate within their business	**Quantitative:** • Data from respondents of the survey will be documented, coded and processed with Statistical Analysis Software (SAS). • **Linear regression analysis** will be used to evaluate factors influencing ICT adoption choices in the SME sector. • **Correlation analysis** will be used to evaluate the relationship between owner/manager education levels and ICT adoption.

3.7 Limitations of the study

This study aims to investigate the barriers of ICT adoption amongst SMEs in the manufacturing sector in South Africa. A significant limitation of the study is that differences may exist between industry sectors and it is therefore necessary to see if similar barriers or obstacles exist in other sectors of industry.

Given that a quantitative approach is chosen for this research, this method may overlook certain issues that might otherwise arise through qualitative research with participants. Hence, richer conclusions can be drawn from a mixed method research design, making use of qualitative structured or semi-structured interviews, which could illicit more in-depth and revealing responses.

Furthermore, the study is a cross-sectional analysis and cannot provide longitudinal analysis, which may be more useful in identifying ICT trends within a firm.

3.8 Validity and reliability

3.8.1 External validity

External validity is determined by the ability to generalise the study results beyond the study sample. Although the manufacturing sector is significant in size, other sectors may require that the questionnaire be further adapted to suit industry specific needs.

3.8.2 Internal validity

The questionnaire that will be administered in this study is based on questionnaires developed and validated by Ismail et al. (2011), looking specifically at ICT usage amongst SMEs.

3.8.3 Reliability

It is extremely important that the research instrument for this study– in this case the online questionnaire – elicits consistent and reliable responses. When variables fall into this category, research questions return a stable response and data can then be said to be reliable (Santos, 1999). Cronbach's alpha is a measure of reliability related to the variation accounted for by the true score of the "underlying construct." Where construct is the hypothetical variable being measured, according to the literature, Cronbach's alpha of 0.7 and above is seen as a reliable score (Gliem, 2003; Santos, 1999).

TABLE 3: CRONBACH'S ALPHA RELIABILITY TEST RESULTS

CONSTRUCT	CRONBACH'S ALHPA
ICTs in use	0.8787
Perceived ICT Value	0.8985
Barriers to ICT adoption	0.8734

Source: Own

Table 3 above shows the results of the Cronbach Alpha Reliability Test performed on the datasets to test whether each of the variables was reliable or not. The results revealed that all three variables meet the reliability criteria – The "ICTs in use" variable scored a Cronbach Alpha of 0.8787; the "Perceived ICT value" variable scored 0.8985, and the "Barriers" variable scored 0.8734.

3.9   Ethics

In this study, the interests and rights of anyone affected by the study were safeguarded. For the purposes of the study, the informed consent of the subjects was obtained. **Annexure C** contains the consent form, which informed the respondents of their confidentiality. The confidentiality of the SMEs sampled had to be maintained; hence no details of the SMEs are mentioned, but rather their typology is noted. The respondents were also not asked to submit their names or personal details.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

In this chapter, the results of the study are presented. The data was analysed using descriptive and multivariate analysis and the results are reported according to the research methodology detailed in the previous chapter. Tables are included for ease of presentation and comparison of results. A description of the sample is presented, depicting the size of the sample, as well as the demographics of the respondents.

4.2 Demographic profile of respondents

A total of 81 respondents of the 250 sampled SMEs completed the survey, a response rate of 32.4 %.

4.2.1 Industry

The survey responses, as seen in **Table 4** and **Figure 10**, indicate that the sampled SMEs occupy a number of industries within the manufacturing sector. The most common industry, which took part in the study, was the textile, clothing and leather goods industry at 27%, followed by 15% in the food, beverages and tobacco, as well as wood and paper and publishing and printing industries, and 12% of the respondents are in the furniture industry.

Table 4: Industry Sector of SMEs

#	Answer		Response	%
11	Food, beverages and tobacco		12	15%
12	Textiles, clothing and leather goods		22	27%
13	Wood and paper; publishing and printing		12	15%
14	Petroleum products, chemicals, rubber and plastic		8	10%
15	Other non-metal mineral products		0	0%
16	Metals, metal products, machinery and equipment		2	2%
17	Electrical machinery and apparatus		7	9%
18	Radio, TV, instruments, watches and clocks		5	6%
19	Transport equipment		3	4%
20	Furniture; other manufacturing		10	12%
21	Other (Please specify):		0	0%
	Total		**81**	**100%**

Figure 10: Industry Sector of SMEs
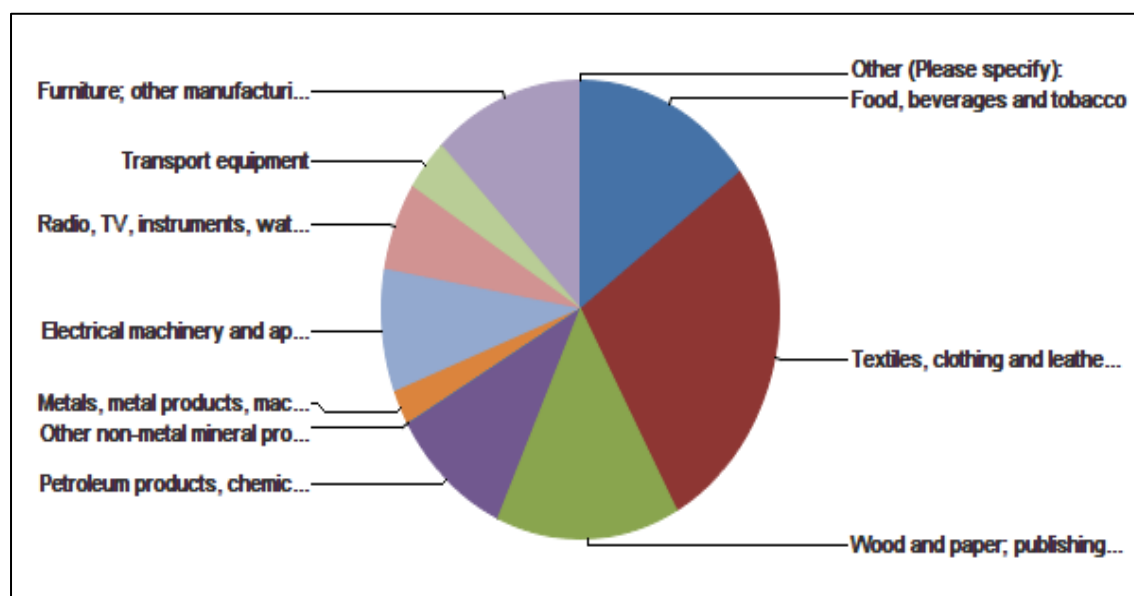
4.2.2 Job function

Of the 81 responses, 65% were from owners of SMEs, as seen in **Table 5** below. Another 35% of responses are from managers of businesses. There were no responses from IT managers or staff.

Table 5: Job Function

#	Answer		Response	%
4	Owner		53	65%
5	Manager		28	35%
6	IT		0	0%
7	Other (Please specify):		0	0%
	Total		81	100%

4.2.3 Years in operation

From the responses, only 5% of SMEs surveyed have been in operation for less than a year. **Table 6** shows that 26% have been operational for one to three years, while a majority 43% have been established for longer, between four to five years. Of the SMEs, 26% were well established with over six years in operation.

Table 6: Years in Operation

#	Answer		Response	%
1	<1		4	5%
2	1-3		21	26%
3	4-5		35	43%
4	6>		21	26%
	Total		81	100%

4.2.4 Number of employees

Table 7 shows the current number of employees at the SMEs surveyed. It indicates that the majority of the SMEs employ between one to ten staff members (46%), 35% employ 11-25 staff members, and 15% employ 26-50 staff members. There were no SMEs from the survey that employed more than 100 staff members. Of the SMEs, 81% had less than 26 employees in their organisations.

Table 7: Number of Employees

#	Answer		Response	%
1	1-10		37	46%
2	11-25		28	35%
3	26-50		12	15%
4	51-100		4	5%
5	>100		0	0%
	Total		81	100%

4.2.5 Level of education

From the responses by SME owners and managers, only 4% have a master's degree or higher as seen in **Table 8** and **Figure 11**. The majority of responders (35%) have a bachelor's degree. Another 30% have a certificate or diploma and 17% hold only a high school certificate.

Table 8: Level of Education

#	Answer		Response	%
1	Primary school		0	0%
2	Secondary/high school		14	17%
3	Certificate/diploma		24	30%
4	Bachelor's degree		28	35%
5	Honours degree		12	15%
6	Master's degree or higher		3	4%
	Total		**81**	**100%**

4.3   Results pertaining to Hypothesis 1

H1: ICTs are perceived by SMEs to add value to their business

Table 9: Perceived Value Added through ICT Use

#	Question	Disagree	Neutral	Agree	Mean
1	Operational costs have decreased since ICT has been adopted	41.98%	35.80%	18.52%	2.74
2	I have experienced increased efficiency of tasks since ICT implementation	19.75%	38.27%	32.10%	3.12
3	**Our quality of service has improved due to ICT**	**16.05%**	**35.80%**	**39.51%**	**3.16**
4	The organisation has become more effective since the adoption of ICT	16.05%	38.27%	33.33%	3.12
5	The organisation has become more marketable	31.25%	35.00%	22.50%	2.94
6	Customer base has increased	23.38%	50.65%	22.08%	2.96
7	Increased revenue since implementation	24.69%	48.15%	20.99%	2.84
8	Customer satisfaction has increased	25.32%	45.57%	21.52%	2.96
9	Business processes are more efficient, tasks are performed quicker	18.75%	38.75%	36.25%	3.10
10	**Turnaround time has improved**	**12.66%**	**40.51%**	**41.77%**	**3.19**
11	Organisation has become more profitable	29.63%	43.21%	23.46%	2.91
12	Relationships with suppliers have been improved	15.19%	45.57%	32.91%	3.10
13	Stock levels are always up to date	17.50%	50.00%	30.00%	3.08
14	Organisational goals are being met with more ease	21.79%	44.87%	29.49%	3.05
15	**Short term targets are more achievable**	**19.23%**	**38.46%**	**38.46%**	**3.17**
16	Product quality has been improved	32.91%	41.77%	24.05%	2.89
17	Staff morale has increased	17.72%	45.57%	30.38%	3.10

18	Communication within the organisation has improved	16.46%	44.30%	25.32%	3.22
19	**Scheduling has become more efficient**	**12.35%**	**29.63%**	**43.21%**	**3.51**
20	Employees are able to work from remote locations	39.51%	14.81%	20.99%	2.67

This part of the research looked at the value added to South African SMEs through ICT use. The hypothesis tested was one that assumed that using ICT in an organisation adds value to that organisation.

The respondents were asked to indicate the extent to which they agreed with a number of statements that describe certain benefits that SMEs could gain when adopting ICT to communicate and/or conduct business on a scale of one to five, with higher values corresponding to higher levels of agreement.

Table 9 summarises and ranks the perceived value added through ICT adoption. The key perceived benefits experienced by SME owners focus on scheduling becoming more efficient (43%), service delivery (39.5%), turnaround time (41%), and achieving short-term targets (38%).

In terms of the perceived value of ICT use, the responses clearly indicate that the SMEs sampled feel that their operations have improved since adopting specific ICTs for their businesses. With a maximum response value of 5, the majority of responders agreed that scheduling has become more efficient (mean: 3.51), turnaround time has increased (mean: 3.75), the organisation has become more efficient (mean: 3.6) since adopting ICT, and short term targets are more achievable (mean: 3.9).

Hypothesis 1: Accepted

4.4 Results pertaining to Hypothesis 2

> **H2: Perceived value of ICT has a positive effect on its adoption and use by SMEs**

To evaluate the hypothesised relationships between the dependent variable (ICT adoption) and the independent variable (perceived value of ICT), a linear regression model was used to test any significance amongst the independent variable perceived value and the dependent variable ICT adoption. Thereafter, a Pearson correlation coefficient was used to quantify the degree to which the two variables are related.

According to the results, the perceived value of ICT has a significant relation to ICT adoption. The results of the linear regression model, as seen in **Table 10** below, indicate that general-use ICT adoption is strongly correlated to the perceived value of ICT with a p-value of 0.00057.

There exists little evidence of a correlation between the perceived value of ICT adoption to that of production-integrating ICT and market-orientated ICT. This is indicated by a high p-value of 0.12773 and 0.12773, respectively.

Table 10: Linear Regression Model for Perceived Value and ICT Adoption

Coefficients:					
	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	2.8125	0.1738	16.181	< 2e-16	***
General_use_ICT_adoption	0.7092	0.1973	3.595	0.00057	***
Production_integrating_ICT_adoption	0.3913	0.2541	1.54	0.12773	
Market_orientated_ICT_adoption	0.7826	0.5083	1.54	0.12773	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Residual standard error: 0.6953 on 77 degrees of freedom					
Multiple R-squared: 0.2246,			Adjusted R-squared: 0.1944		
F-statistic: 7.434 on 3 and 77 DF, p-value: 0.000195					

The results of the Pearson correlation coefficients, as seen in **Table 11** below, show that perceived ICT value and general-use ICT adoption has a strongly correlated coefficient of 0.40. Perceived ICT value and production-integrating ICT adoption has a lower but still positive correlation coefficient of 0.25. This is similar to perceived ICT value and market-orientated ICT adoption, with a coefficient of 0.21.

Table 11: The Pearson Correlation Coefficients for Perceived Value and ICT Adoption:

Perceived ICT value and General_use_ICT_adoption	
	0,4072903
Perceived ICT value and Production_integrating_ICT_adoption	
	0,2551552
Perceived ICT value and Market_orientated_ICT_adoption	
	0,2181747

Hypothesis 2: Accepted

4.5   Results pertaining to Hypothesis 3

H3: Most SMEs make use of General-use ICTs

In order to distinguish between the degree of ICT use and to test the hypothesis, ICT usage was categorised into three subsections of use, namely general ICT technology usage, production-orientated ICT technology usage and market-orientated ICT usage. The general-use ICTs consisted of the following technologies: VoIP, Internet access, e-mail, telephone (landline), and fax lines. Descriptive analysis was used to determine the level of ICT adoption amongst the three sub-sections.

The results showed that most SMEs had Internet access, e-mail services and a telephone and fax line. More specifically the results revealed that the majority of participants make use of VoIP (69%), Internet access and e-mail (90%), telephone (89%) and fax lines (82%) as the ICTs already implemented.

Figure 11: General ICT Usage
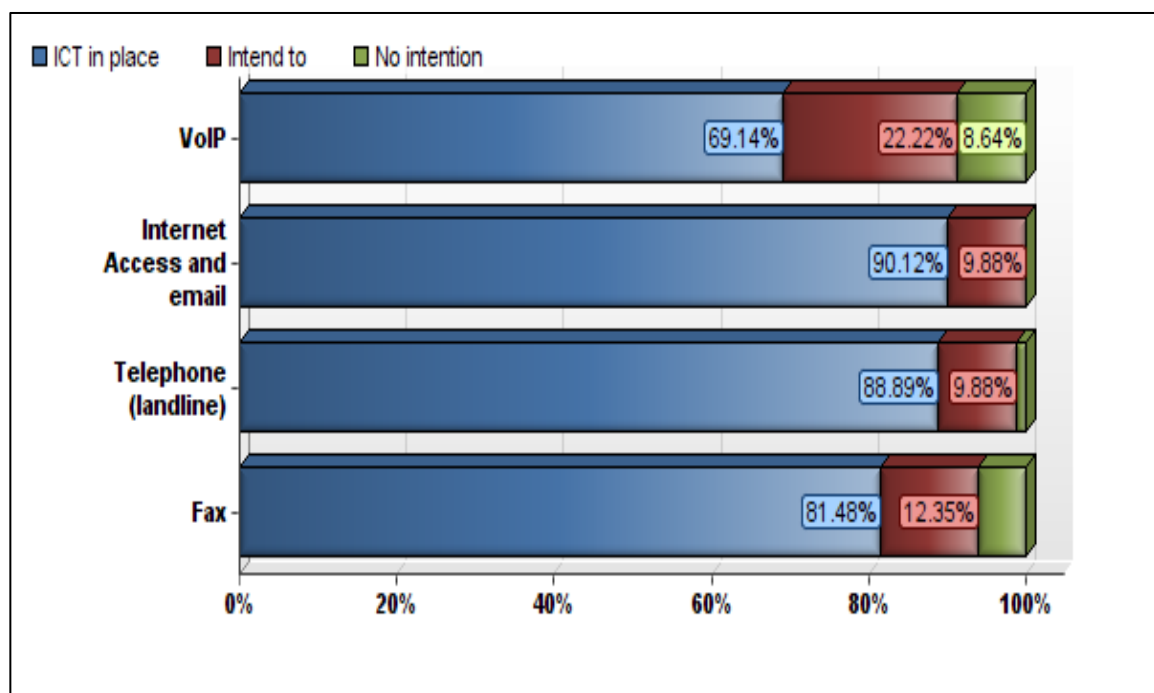
Table 12: General ICT Usage

#	Question	ICT in place	Intend to	No intention	Total responses	Mean
1	VoIP	69.14%	22.22%	8.64%	81	1.40
2	Internet access and e-mail	90.12%	9.88%	0.00%	81	1.10
3	Telephone (landline)	88.89%	9.88%	1.23%	81	1.12
4	Fax	81.48%	12.35%	6.17%	81	1.25

Of the general ICT users, as seen in **Figure 11** and **Table 12**, 69% of SMEs had adopted VoIP, with a further 22% intending to implement it. Internet access and e-mail had a high usage rate of 90%, with a further 9.8% intending to incorporate it into their businesses. Telephone (landline) use was also high at 89%, with the remainder (9.8%) looking to implement it at some stage in their business. Lastly, 81% had fax line in place with only 6% having no interest in implementing it in their business.

Table 13: Production Integrating ICT Usage

#	Question	ICT in place	Intend to	No intention	Mean
5	Enterprise Resource Planning System	9.88%	12.35%	77.78%	2.68
6	Customer Relationship Management System	8.64%	23.46%	67.90%	2.59
7	Supply Chain Management System	16.05%	28.40%	55.56%	2.40
8	Intranet	1.23%	11.11%	87.65%	2.86
13	Open Source Software	6.17%	19.75%	74.07%	2.68
14	Mobile Payment System	48.15%	35.80%	16.05%	1.68

15	Finance & Accounting Software	24.69%	46.91%	28.40%	2.04
16	Document Management Software (DMS)	9.88%	18.52%	71.60%	2.62
17	Inventory Management Software	9.88%	44.44%	45.68%	2.36
18	Cloud Computing	2.47%	28.40%	69.14%	2.67

The production-integrating ICTs include Enterprise Resource Planning Systems, Customer Relationship Management Applications (CRM), Supply Chain Management Systems, Intranet, Open Source Software, Mobile Payment Systems; Finance and Accounting Software, Document Management Systems (DMS), Inventory Management Software, and Cloud Computing.

As can be seen from **Table 13**, there is a significantly low use of production-integrating ICTs. The percentage of ICTs in place are: Enterprise Resource Planning Systems (ERP) (9.88%), Customer Relationship Management Applications (8.64%), Supply Chain Management Systems (16%), Intranet (1.23%), Open Source Software (6.17%), Mobile Payment Systems (48.15%), Finance and Accounting Software (24.69%), Document Management Systems (9.88%), Inventory Management Software (9.88%), and Cloud Computing (2.47%).

Figure 12: Production-Integrating ICT Usage
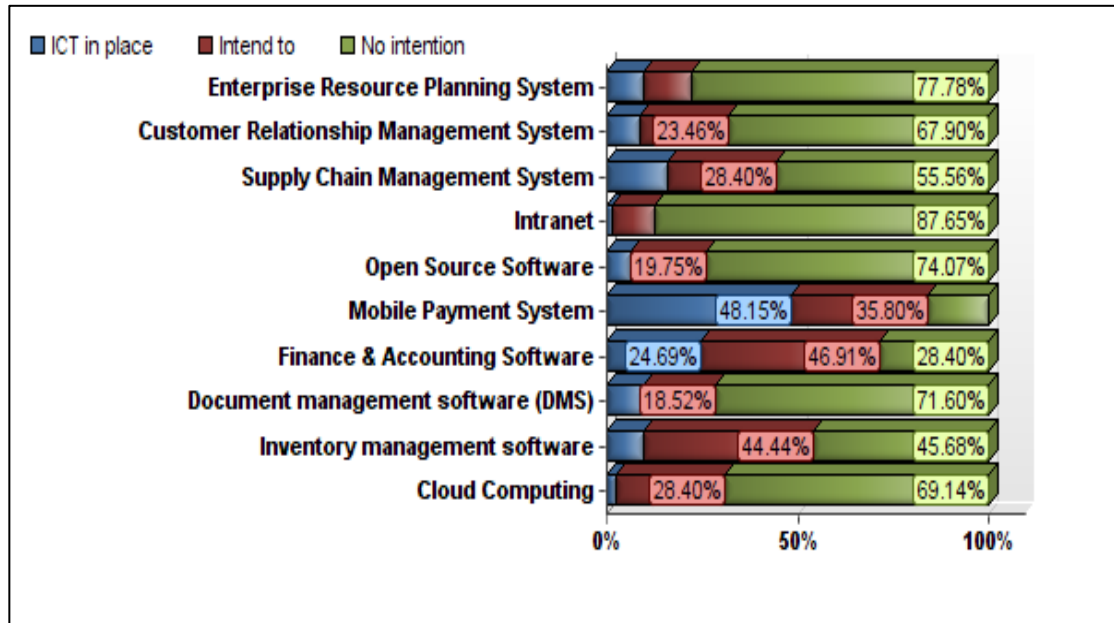
As seen in **Figure 12** above, along with the low level of ICT adoption, there is a significant lack of intention from the SMEs sampled to include various production-integrating ICTs in their business. The figures are as follows: Enterprise Resource Planning Systems (77%%), Customer Relationship Management Applications (67%), Supply Chain Management Systems (55%), Intranet (87.65%), Open Source Software (74%), Mobile Payment Systems (16%), Finance and Accounting Software (28%), Document Management Systems (71%), Inventory Management Software (45%), and Cloud Computing (69%).

Figure 13: Market-Oriented ICT Usage
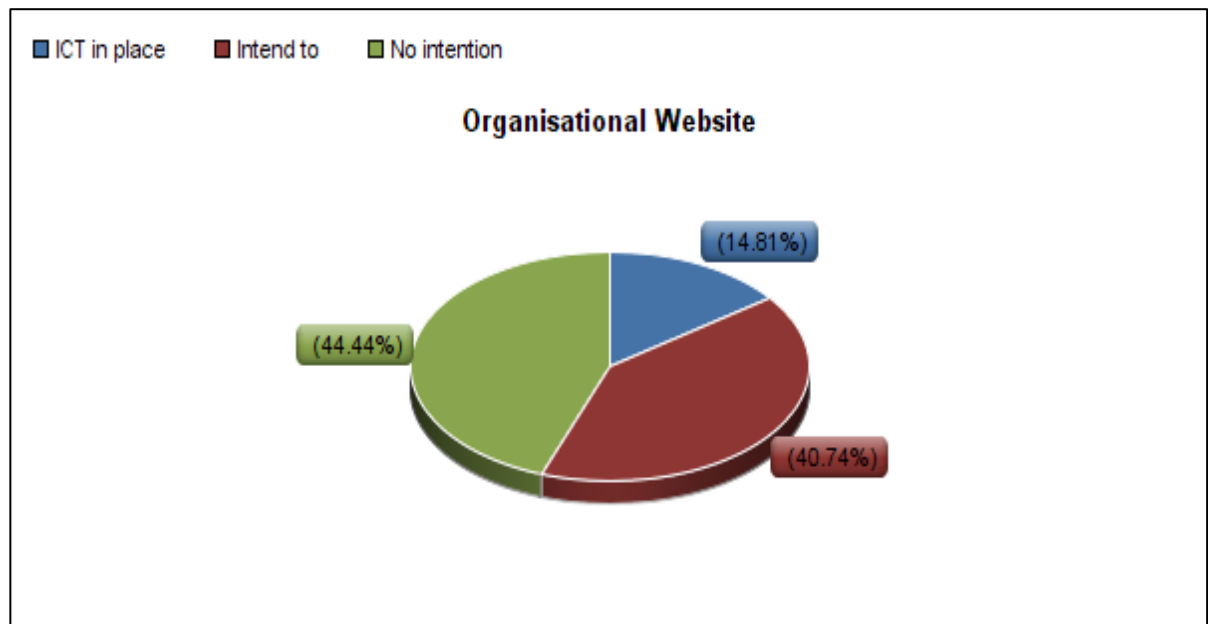
The market-oriented ICT usage showed that only 14.8% of the SMEs sampled had an organisational website in place that they used for marketing. A majority of 44.4% had no intention of implementing a website, while 40.7% had some intention to create a website for their business at some stage. Overall the top ranked ICTs in use within the sample are Internet access and e-mail (90%), as well as landlines (88%). The lowest ranked ICTs were Intranet (1.23%) and Cloud Computing (2.47%). The findings clearly show that the sample consisted mainly of general-use ICT users, followed by production-orientated ICT users, with very few SMEs using market-orientated ICTs.

Hypothesis 3: Accepted

4.6 Results pertaining to Hypothesis 4

H4: External factors are the greatest barriers to ICT adoption amongst SMEs

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4.6.1 Descriptive statistics

Figure 14: External Barriers to ICT Adoption
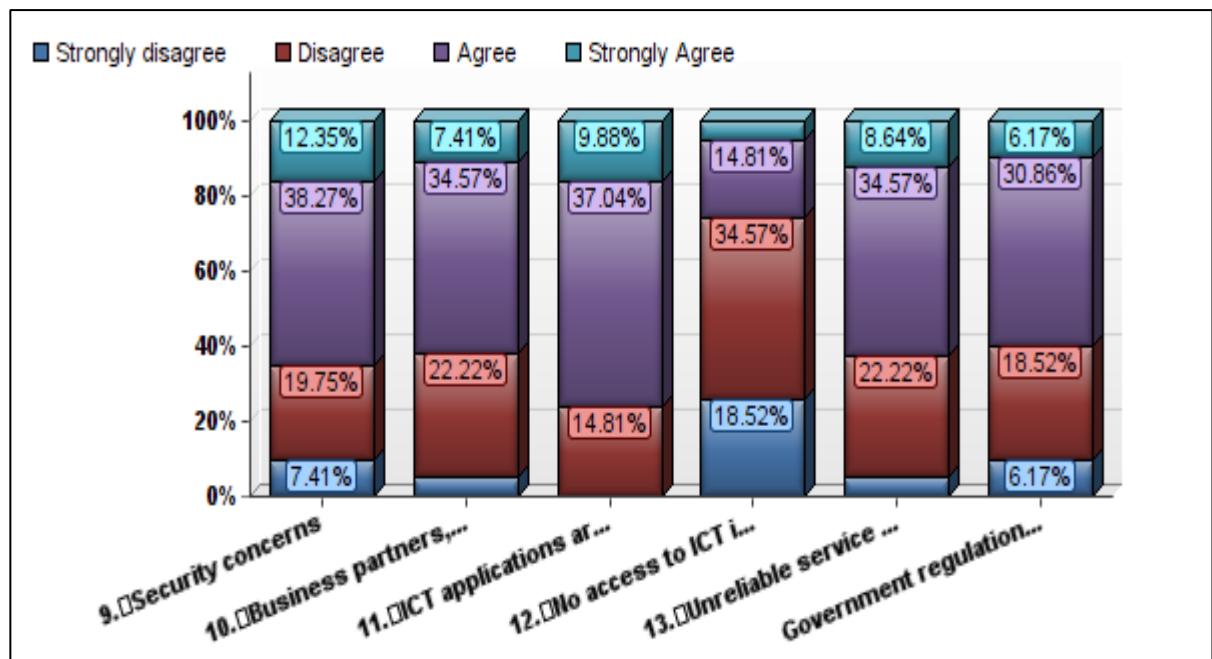
This component of the study looked at the various barriers experienced with regard to ICT adoption and use within South African SMEs. More specifically, the research intended to look at the external barriers for ICT usage and whether or not South African SMEs experience significant barriers to adoption and usage.

Descriptive information for the characteristics of the sample is summarised in **Figure 14** and **Table 14**. From **Figure 14** above it can be seen that 38% of the respondents feel that security concerns are a hindrance to ICT adoption. Of these 35% believe that business partners, suppliers and customers do not

make use of ICT. A further 37% are of the opinion that ICT applications are not tailored to the way SMEs do business. Another 30% agree that government regulations were a barrier experienced by SME managers and owners when adopting ICTs.

Table 14: External Barriers to ICT Adoption

Statistic	Security concerns	Business partners, suppliers and customers do not make use of ICT	ICT applications are not tailored to the way SMEs do business	No access to ICT infrastructures (e.g. electricity, telephone lines, etc.)	Unreliable service providers	Government regulations
Min Value	1	1	2	1	1	1
Max Value	5	5	5	5	5	5
Mean	**3.28**	**3.20**	**3.42**	**2.51**	**3.22**	**3.12**
Variance	1.31	0.99	0.75	1.15	1.03	0.98
Standard Deviation	1.14	0.99	0.86	1.07	1.01	0.99
Total Responses	81	81	81	81	81	81

In **Table 14** above, with a maximum value of 5, the results indicate that the major external barriers to ICTs adoption by SMEs are that ICT applications are not tailored to the way SMEs do business (mean: 3.42), as well as security concerns (mean: 3.28) and unreliable service providers (mean: 3.22).

4.6.2 Multivariate statistics: Logistic regression

A logistic regression model was used to determine the impact of the independent variables (external barriers) on ICT adoption (dependent variable). The significance of the regression coefficients of the hypothesised independent variables were examined to determine support for the

hypothesis. The p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (< 0.05) indicates that the null hypothesis can be rejected. This means that a predictor that has a low p-value is likely to be a meaningful addition to one's model because changes in the predictor's value are related to changes in the response variable. Conversely, a larger (insignificant) p-value suggests that changes in the predictor are not associated with changes in the response (Frost, 2013). The regression coefficient of independent variables on ICT adoption was estimated. The overall model is significant at the 1% level.

Table 15: Logistic Regression (General-Use ICT)

Coefficients:	Column1	Column2	Column3	Column4	Column5
	Beta	Std. Error	z value	Pr(>|z|)	
(Intercept)	6.6482	2.2446	2.962	0.00306	**
Q8_9_Security_concerns	-0.1784	0.4176	-0.427	0.66926	
Q8_10_Agnostic_stakeholders	-0.7013	0.5294	-1.325	0.18525	
Q8_11_Not_tailored_to_SMEs	0.1536	0.4816	0.319	0.74974	
Q8_12_No_access to ICT infrastructure	-1.4143	0.5915	-2.391	0.01679	*
Q8_13_Unreliable_service_provider	0.5693	0.5481	1.039	0.29891	
Q8_14_Government_regulations	-0.1449	0.5511	-0.263	0.79263	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

In **Table 15** above, the logistic regression results for general-use ICT shows that no access to ICT infrastructure is significantly related to ICT adoption with a p-value of 0.01679.

Table 16: Logistic Regression (Production-Integrating ICT)

Coefficients:	Column1	Column2	Column3	Column4
	Beta	Std. Error	z value	Pr(>|z|)
(Intercept)	1.81422	1.92293	0.943	0.345
Q8_9_Security_concerns	-0.31775	0.37578	-0.846	0.398
Q8_10_Agnostic_stakeholders	-0.48072	0.51509	-0.933	0.351
Q8_11_Not_tailored_to_SMEs	-0.39636	0.5006	-0.792	0.428
Q8_12_ No_access to ICT infrastructure	0.04864	0.57792	0.084	0.933
Q8_13_Unreliable_service_provider	-0.62421	0.51835	-1.204	0.229
Q8_14_Government_regulations	0.49421	0.47791	1.034	0.301
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

In **Table 16** above, the regression results for production-integrating ICT adoption shows that there is no significant relationship between the external factors and ICT adoption. This can be seen in the high p-value for all factors which suggests that changes in the predictor are not associated with changes in the response.

Table 17: Logistic Regression (Market-Orientated ICT)

Coefficients:	Column1	Column2	Column3	Column4
	Beta	Std. Error	z value	Pr(>|z|)
(Intercept)	-2.2828	4.0916	-0,558	0,577
Q8_9_Security_concerns	-0.2614	0.8783	-0,298	0,766
Q8_10_Agnostic_stakeholders	-0.3286	1.0191	-0,322	0,747
Q8_11_Not_tailored_to_SMEs	-1.0811	1.3241	-0,816	0,414
Q8_12_ No_access to ICT infrastructure	-0.3958	1.0287	-0,385	0,7
Q8_13_Unreliable_service_provider	0.6586	0.9648	0,683	0,495
Q8_14_Government_regulations	0.7527	1.0629	0,708	0,479

In **Table 17** above, the regression results for market-orientated ICT adoption indicate that there is no significant relationship between the external factors

and ICT adoption. All p-values for the predictor variable show a high insignificance.

Hypothesis 4: Rejected

4.7 Results pertaining to Hypothesis 5

H5: Internal factors are the greatest barriers to ICT adoption amongst SMEs

4.7.1 Descriptive statistics

Descriptive statistics for the characteristics of the sample is summarised in **Figure 15** and **Table 18**. From **Figure 15** below it can be seen that 54% of the respondents are of the opinion that ICTs are too expensive to implement in their businesses. Also, 49% consider the low level of existing hardware technology in place as a significant barrier. Significantly, 44% think that time constraints are a major hindrance to implementing ICT.

Figure 15: Descriptive Statistics (Internal Barriers)
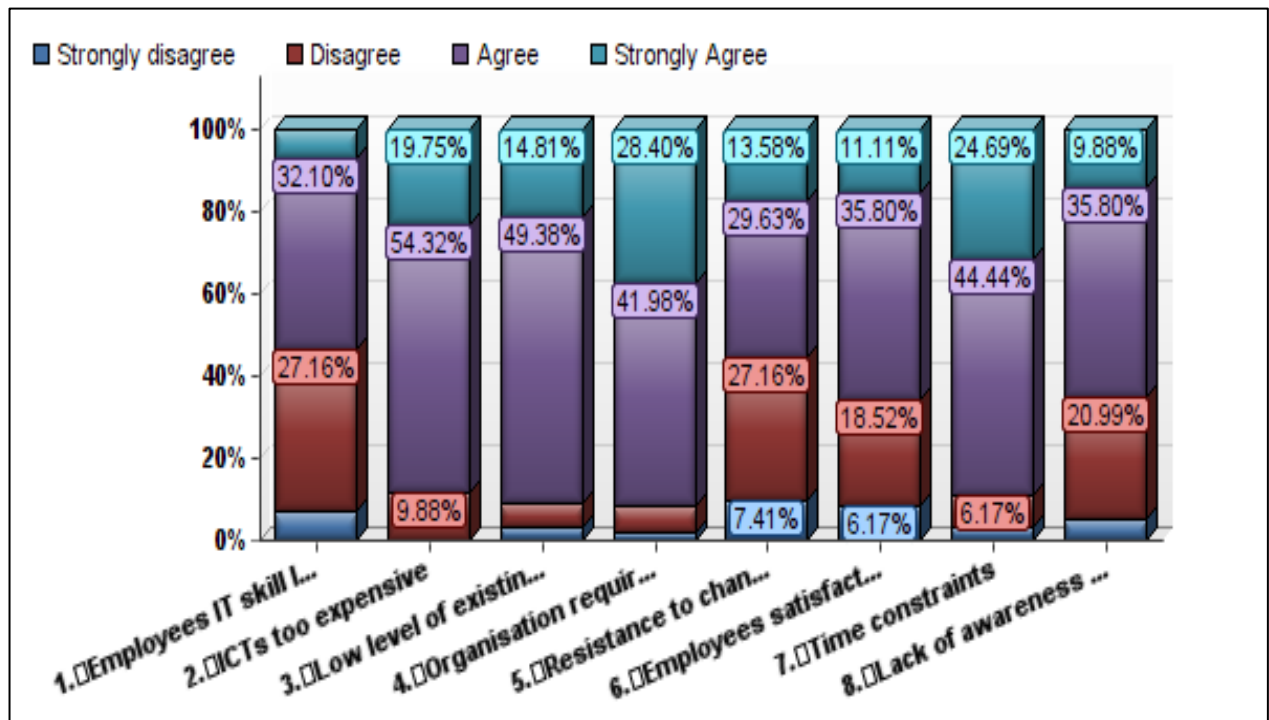
Table 18: Descriptive Statistics (Internal Barriers)

Statistic	Employees'IT skills levels were too low	ICTs too expensive	Low level of existing hardware technology in place	Organisation required immediate ROI, ICT implementation would not deliver this result	Resistance to change within the organisation	Employees' satisfaction with traditional technologies	Time constraints	Lack of awareness about the benefits of ICT
Min Value	1	2	1	1	1	1	1	1
Max Value	5	5	5	5	5	5	5	5
Mean	**3.05**	**3.84**	**3.70**	**3.91**	**3.15**	**3.27**	**3.83**	**3.27**
Variance	1.00	0.74	0.74	0.83	1.40	1.18	0.92	1.05
Standard Deviation	1.00	0.86	0.86	0.91	1.18	1.08	0.96	1.02
Total Responses	81	81	81	81	81	81	81	81

In **Table 18** it can be seen that of a maximum value of 5, the mean values for internal factors are significantly high with a low standard deviation. A low standard deviation means that most of the numbers are very close to the average. A high standard deviation means that the numbers are spread out.

For the section on organisations required immediate ROI, ICT implementation would not deliver this result, we see a mean of 3.91 (SD= 0.91). Significantly, time constraints show a mean score of 3.83 (SD= 0.96). Lastly, the cost of ICTs is seen as a significant barrier with a mean of 3.84 (SD= 0.86).

4.7.2 Multivariate statistics: Logistic regression

A Logistic regression model was used to determine the impact of the independent variables (internal barriers) on ICT adoption (dependent variable). The significance of the regression coefficients of the hypothesised independent variables were examined to determine support for the hypothesis. The p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (< 0.05) indicates that the null hypothesis can be rejected. In other words, a predictor that has a low p-value is likely to be a meaningful addition to the model because changes in the predictor's value are related to changes in the response variable. Conversely, a larger (insignificant) p-value suggests that changes in the predictor are not associated with changes in the response (Frost, 2013).

Table 19: Logistic Regression Model (General-Use ICT)

Coefficients:	Column 1	Column 2	Column 3	Column 4	Column 5
	Beta	Std. Error	z value	Pr(>|z|)	
(Intercept)	2.48633	1.80969	1.374	0.1695	
Q8_1_IT_skill_shortage	-0.17903	0.40475	-0.442	0.6582	
Q8_2_Cost_too_high	.,77351	0.59037	1.31	0.1901	
Q8_3_Lack_of_existing_hardware	**-1.27689**	**0.61557**	**-2.074**	**0.0381**	*
Q8_4_Immediate_ROI	**1.10646**	**0.49016**	**2.257**	**0.024**	*
Q8_5_Change_inertia	-0.12162	0.44383	-0.274	0.7841	
Q8_6_Current_tech_satisfaction	-0.84996	0.5416	-1.569	0.1166	
Q8_7_Time_constraints	-0.08119	0.53963	-0.15	0.8804	
Q8_8_Lack_of_awareness	0.25233	0.45274	0.557	0.5773	

Signif. codes: 0 '***' 0.001 '	**' 0.01	'*' 0.05 '	.' 0.1 '	1	

In **Table 19** above, the regression results for general-use ICT adoption show that the lack of existing hardware in place is a significant barrier with a p-value of 0.0381. Immediate ROI was seen as another significant barrier with a p-value of 0.024. The beta value is a measure of how strongly each predictor variable influences the criterion (dependent) variable. The beta value for immediate ROI, as seen in Column 1, is 1.106, indicating that it is significant relative to the other factors tested in the model.

Table 20: Logistic Regression Model (Production-Integrating ICT)

Coefficients:	Column 1	Column 2	Column 3	Column 4	Column 5
	Beta	Std. Error	z value	Pr(>|z|)	
(Intercept)	1.7515	2.455	0.713	0.4756	
Q8_1_IT_skill_shortage	0.60202	0.56595	1.064	0.2874	
Q8_2_Cost_too_high	0.99619	0.75205	1.325	0.1853	
Q8_3_Lack_of_existing_hardware	**-2.5805**	**1.09601**	**-2.354**	**0.0186**	*
Q8_4_Immediate_ROI	-0.16618	0.66466	-0.25	0.8026	
Q8_5_Change_inertia	-0.72467	0.7932	-0.914	0.3609	
Q8_6_Current_tech_satisfaction	0.74167	0.80042	0.927	0.3541	
Q8_7_Time_constraints	-0.18476	0.70034	-0.264	0.7919	
Q8_8_Lack_of_awareness	0.09076	0.70355	0.129	0.8974	

In **Table 20**, the regression results for product-integrating ICT adoption show that the lack of existing hardware in place is significantly related to ICT adoption with a p-value of 0.0186.

Table 21: Logistic Regression Model (Market-Orientated ICT)

Coefficients:	Column 1	Column 2	Column 3	Column 4
	Beta	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.0437	4.9403	-0.211	0833
Q8_1_IT_skill_shortage	0.1527	1.0894	0.14	0.889
Q8_2_Cost_too_high	-0.1161	1.4201	-0.082	0.935
Q8_3_Lack_of_existing_hardware	-1.8361	1.8887	-0.972	0.331
Q8_4_Immediate_ROI	1.2944	1.3291	0.974	0.33
Q8_5_Change_inertia	-0.9073	1.3227	-0.686	0.493
Q8_6_Current_tech_satisfaction	0.7986	1.4952	0.534	0.593
Q8_7_Time_constraints	0.3734	1.4374	0.26	0.795
Q8_8_Lack_of_awareness	-1.0935	1.1928	-0.917	0.359

In **Table 21** above, the regression results for market-integrating ICT adoption, show no significant internal barriers with all factors displaying high p-values.

Hypothesis 5: Accepted

4.8   Results pertaining to Hypothesis 6

> **H6: Owners/managers with a higher education level have a higher ICT adoption rate within their businesses**

To evaluate the hypothesised relationships between the variables, a linear regression model was used to test any significance amongst the independent variable *education level* and the dependent variable *ICT adoption*. Thereafter, a Pearson correlation coefficient was used to quantify the degree to which the two variables are related.

The correlation coefficient is a number between –1 and 1 that determines whether two paired sets of data are related. The closer to 1 the coefficient is, the more 'confident' we are of a positive linear correlation and, the closer to – 1, the more confident we are of a negative linear correlation. When the correlation coefficient is close to zero there is no evidence of any relationship (Bewick, 2003).

The results of each of the linear regression models indicate that there is a significant relationship between the level of education and ICT adoption for general-use and production-integration ICTs.

The results of the linear regression model, as seen in **Table 22** below, indicate that there is a significant link between education levels and general-use ICT adoption with a p-value of 0.00742. General-use ICT adoption shows a strong positive correlation coefficient (0.2954) to level of education.

Table 22: Linear Regression Model (General-Use ICT)

Coefficients:				
Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept) -0.27224	0.39337	-0.692	0.49093	
Q5 0.24730	0.08998	2.748	0.00742	**

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**				

Correlation Coefficient

0,2954149	

Table 23: Linear Regression Model (Production-Integrating ICT)

Coefficients:

Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept) -0.81132	0.30779	-2.636	0.0101	*
Q5 0.21226	0.07041	3.015	0.00346	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation Coefficient

0,3212226

The results of the linear regression model, as seen in **Table 23** above, indicate that there is a significant link between education levels and production-integrating ICT adoption with a p-value of 0.00346. Production-integrating ICT adoption shows the strongest positive correlation (0.3212226) to level of education.

Table 24: Linear Regression Model (Market-Orientated ICT)

Coefficients:

Estimate	Std. Error	t value	Pr(>|t|)
(Intercept) - 0.04852	0.16027	-0.303	0.763
Q5 0.01685	0.03666	0.46	0.647

Correlation Coefficient

0,0516291

The results of the linear regression model, as seen in **Table 24** above, indicate that there is little evidence to suggest a significant link between education levels and market-orientated ICT adoption with a p-value of 0.647. Market-orientated ICT adoption shows a weak correlation coefficient (0.0516) to level of education.

Hypothesis 6: Accepted

4.9   Summary of the results

This chapter provided an overview of the results of the study. The chapter covered the demographics of the sample, the linear and logistic regression models and, finally, the correlation analysis that pertains to the six hypotheses outlined in Chapter 3.

In summary, evidence was found to support Hypothesis 1, showing that SMEs are of the opinion that ICT does indeed add value to their business. From the perceived value of ICT use, the responses clearly indicate that the SMEs sampled think that their operations have improved since adopting specific ICTs within their businesses. With a maximum value of 5, the majority of respondents agreed that scheduling has become more efficient (mean: 3.51), turnaround time has increased (mean: 3.75), the organisation has become more efficient (mean: 3.6) since adopting ICT, and short term targets are more achievable (mean: 3.9).

Evidence was found to support Hypothesis 2. According to the results, the perceived value of ICT has a significant relation to ICT adoption. The results of the linear regression model indicate that general-use ICT adoption is strongly correlated to the perceived value of ICT with a p-value of 0.00057.

Hypothesis 3 aimed to ascertain whether SMEs predominantly make use of general-use ICTs. Through the use of descriptive statistics, it became clear that the sample consisted mainly of general-use ICT users, followed by production-integrating ICT users, while very few SMEs were using market-orientated ICTs. Hence, Hypothesis 3 is accepted. The findings showed that the majority of participants have VoIP (69%), Internet access and e-mail (90%), and telephone (89%) and fax lines (82%) as one of the ICTs already implemented.

Hypothesis 4 proposed that external barriers significantly prevent ICT adoption. However, the results of the linear regression analysis proved this to

be false as the model identified external barriers to have no significant impact on ICT adoption. Hence, Hypothesis 4 is rejected.

Hypothesis 5 proposed that internal barriers significantly prevent ICT adoption. The linear regression analysis showed that for general-use ICT, the lack of existing hardware in place was a significant barrier to ICT adoption with a p-value of 0.0381. Immediate ROI was another significant barrier, with a p-value of 0.024. Hypothesis 5 was thus accepted.

Hypothesis 6 aimed to establish whether education levels have a notable and direct influence on owners/managers' ICT adoption. The results of each of the linear regression models indicate that there is indeed a significant relationship between the level of education and ICT adoption for general-use and production-integration ICTs. Furthermore, the production -integrating ICTs showed the strongest correlation (0.3212226) to level of education. Hypothesis 6 was therefore accepted.

CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

The purpose of this chapter is to discuss the results of the research that were presented in the previous chapter. The discussion also seeks to compare the findings of this research with the theoretical foundations drawn from previous literature as discussed in Chapter 2. The chapter starts with a discussion of the demographic profile of the sample. The results pertaining to the structural aspects of the model are then discussed, covering the findings on each hypothesis.

5.2 Demographic profile of respondents

A total of 81 respondents of the 250 sampled SMEs completed the survey, thus a response rate of 32.4 %. This response rate, although not ideal, was expected given the size of the sample and the limited access to the details of the respondents.

The respondents of the online questionnaire were owners (65%) or managers of a company (35%). There were no responses from IT managers or staff. This is to be expected as the majority of firms in the sample had between one to ten employees (45%), and senior management in these SMEs are often the point of contact within the business.

The current number of employees at the SMEs surveyed indicates that the majority of the SMEs employed between one to ten staff members (46%), while 35% employed 11-25 staff members and 15% employed 26-50 staff members. There were no SMEs from the survey that employed more than 100 staff members. Of these SMEs, 81% had less than 26 employees in their organisations. A total of 46% of SMEs have been in operation for four to five years, and only 26% for more than six years. These results are also in line

with expectations prior to the study. It was expected the SMEs sampled would be fairly new businesses with a small staff complement. With this in mind, the study envisaged to gain better knowledge about whether fledgling businesses were making use of ICTs in their businesses to add competitive advantage.

5.3 Discussion pertaining to Hypothesis 1

H1: ICTs are perceived by SMEs to add value to their business

In summary, evidence was found to support Hypothesis 1, showing that SMEs are of the opinion that ICT does indeed add value to their business. Despite the fact that a majority of SMEs in the sample make use of general ICT technologies rather than production-integrating and market-orientated technologies, they still seem to think that investing in ICTs could add value to their enterprises. Interestingly, employee-centered benefits and financial impacts appear not to be major benefits from ICT adoption.

From the perceived value of ICT use, the responses clearly indicate that the SMEs sampled think that their operations have improved since adopting specific ICTs within their businesses. With a maximum value of 5, the majority of respondent agreed that scheduling has become more efficient (mean: 3.51), that the turnaround time has increased (mean: 3.75), that the organisation has become more efficient (mean: 3.6) since adopting ICT, and that short term targets are more achievable (mean: 3.9). This is also in line with the findings from Ismail et al, (2011) who argue that the adoption of ICT services does add value. Their findings maintain that general ICT usage is the most adopted form of ICT, followed by production-orientated and advanced ICT use. However, the most notable benefit for adoption sited in their report was that the "organisation has turned out to be more marketable and they

have been able to increase their customer base as a result" (Ismail et al., 2011). In this study, however, this was found not to be true as only 22% of the respondents were of the opinion that their businesses had become more marketable because of ICT adoption.

5.4 Discussion pertaining to Hypothesis 2

H2: Perceived value of ICT has a positive effect on its adoption and use by SMEs

Evidence was found to support Hypothesis 2. According to the results, the perceived value of ICT has a significant relation to ICT adoption. The results of the linear regression model indicate that general-use ICT adoption is strongly correlated to the perceived value of ICT, with a p-value of 0.00057.

Davis (1989) defines perceived value as "the belief that using a particular technology will enhance the potential user's job performance." Similarly, Kiveu's (2013) study on ICT adoption and use among SMEs in Kenya reveals that ICT adoption is influenced by perceived value. This means that a potential user of ICT is more likely to adopt the ICT if she or he perceives the technologies as useful. According to the results by Alam and Noor (2009), a perceived benefit has a significant relation to ICT adoption. This is to be expected as past literature has consistently shown that perceived benefit has a significant and positive influence on ICT adoption (Bingi et al., 2000; Grover & Goslar, 1993; Wang & Tasai, 2002).

According to Giovanni and Mario (2003), the usage of ICT applications for business purposes has numerous advantages for its user. Presently, most SMEs are curious about the benefits of appropriate ICT implementation. Implementing ICT in an organisation could offer businesses a wide range of possibilities for improving their competitiveness, such as providing mechanisms for getting access to new market opportunities and specialised

information services. This follows on studies by Kim, Chan and Gupta (2007), which shows that perceived value has a significant effect on adoption intention. Furthermore, it fully mediates the effects of usefulness, enjoyment, technicality and perceived fee on adoption intention. This is consistent with prior research on perceived value which has recurrently verified perceived value as a predictor of intention (Kim, Chan and Gupta, 2007),

In conclusion, the findings of this research are well supported by the relevant academic literature. Hypothesis 2 is thus accepted.

5.5 Discussion pertaining to Hypothesis 3

> **H3: Most SMEs make use of general-use ICTs**

Hypothesis 3 aimed to ascertain whether SMEs predominantly make use of general-use ICTs. By using descriptive statistics, it became clear that the sample consisted mainly of general-use ICT users, followed by production-orientated ICT users, while only a few SMEs used market-orientated ICTs. Hence, Hypothesis 3 is accepted.

The findings showed that the majority of participants have VoIP (69%), Internet access and e-mail (90%), and telephone (89%) and fax lines (82%) as ICTs already implemented.

The results showed that most SMEs in South Africa make use of general ICT technologies, rather than more advanced and newer ICT technologies that are available for use. This was expected as the cost and skills related to more advanced ICTs are often a significant challenge for SMEs who usually have limited resources. This is also one of the reasons that most South African SMEs tend to adopt and use general ICTs rather than more advanced technologies. Surprisingly however, a significant proportion of the SMEs in the sample intended to implement more advanced technology in their firms. This,

then, is also in line with the findings of Ismail et al. (2011) who suggest that general ICT usage is the most adopted form of ICT, followed by production-orientated and advanced.

According to the existing literature, SMEs tend to adopt basic ICT infrastructure, such as email and we Internet services which may be more valuable to them on an operational level rather than a strategic one. In turn, this could potentially be interpreted as being in line with Brown and Lockett's (2004) study, which argue that SMEs feel more at ease with low complexity ICT applications and tend avoid the more complex applications. Parida et al. (2010) state that SMEs do not adopt more complex ICT services because they are unfeasible or may not suit the nature of their specific businesses. In fact, their research indicates that ICT providers tend to target large firms as they usually have adequate resources and are willing to pay for more complex ICT services. Their products are often too expensive and too complex for SME users. Unsurprisingly, the findings related to Hypothesis 3 are well supported by the relevant academic literature.

5.6 Discussion pertaining to Hypothesis 4

> **H4: External factors are the greatest barriers to ICT adoption amongst SMEs**

Hypothesis 4 proposed that external barriers significantly prevent ICT adoption. Lack of infrastructure was highlighted by the respondents as being the only external barrier of statistical significance. However, the results of the linear regression analysis proved this to be false as the model identified external barriers to have no significant impact on ICT adoption overall. This is surprising as it was expected that external barriers would have a far greater influence on ICT adoption, particularly in a developing nation such as South Africa where there are a number of infrastructure and regulatory challenges.

The finding for this study also goes against numerous studies which highlight the lack of infrastructure and government regulations as significant external barriers to ICT adoption.

According to Kapurubandara et al (2006), the availability of ICT infrastructure is an important factor that hinders the adoption of ICT by SMEs. If there is sufficient ICT infrastructure in a country, it is far easier for SMEs to adopt ICT. Their study found that the availability of Internet facilities and telecommunication services were some of the barriers affecting the adoption of ICT by SMEs in developing economies. In Apulu and Latham's (2009) study in Nigeria, they also found that the unstable nature of the electricity supply in the country was one of the key factors affecting the adoption of ICT as information technologies work hand-in-hand with stable sources of electricity supply.

It was also expected that this study would reveal that regulatory and government barriers would be significant hurdles to ICT adoption. However, this was shown to be false. A study by Kapurubandara and Lawson (2006) showed that prioritising external support activities, particularly legal and regulatory ones, demand direct intervention from the government for solutions. Similarly, the government's role in an overly bureaucratic regulatory system results in delays in its decisions and is extremely costly. Appropriate legal and regulatory frameworks would thus ensure that SMEs operate on a level playing field.

The findings related to Hypothesis 4 are in contradiction to the relevant academic literature and is therefore rejected.

5.7 Discussion pertaining to Hypothesis 5

H5: Internal factors are the greatest barriers to ICT adoption amongst SMEs

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Hypothesis 5 proposed that internal barriers significantly prevent ICT adoption. The linear regression analysis showed that for general-use ICT, the lack of existing hardware in place was a significant barrier to ICT adoption, with a p-value of 0.0381. Immediate ROI was another significant barrier with a p-value of 0.024. The descriptive analysis also indicated that respondents were of the opinion that cost and time constraints were also important barriers. The findings confirm that SMEs in South Africa experience significant internal barriers to ICT adoption and use.

MacGregor et al. (2002) argue that some of the barriers to ICT adoption are unique to SMEs, including the low level of existing hardware technology. The lack of existing technology can be closely related to the cost of this hardware. Cost, as the literature shows, is a common barrier for SMEs.

Cost was discovered as one of the most significant barriers in the adoption of ICT by SMEs in South Africa. This is consistent with studies by Adam (2003), Ismail, Jeffery and Van Belle (2011), and Harindranath et al. (2008) whose findings indicate that cost plays a critical role in ICT adoption in organisations. Even in SMEs that are already established and using ICT, cost remains a critical issue. Lee and Kim (2004) state that even the adopters of ICT are unwilling to upgrade their information systems or to adopt other advanced ICT service applications as a result of the high adoption cost.

The cost of training and up skilling employees has continued to be a key issue amongst SMEs. In most SMEs, there is reluctance amongst owner/managers to invest in training their employees because they are afraid of losing their them to large companies on completion of such training when qualifications

are increased (Arendt, 2008). Also, some SME managers believe that maintaining ICT infrastructures requires a substantial amount of money. SME owners seemed to be of the opinion that ICTs are too costly to invest in as many of them do not have an understanding of the benefits that ICT could have. In line with Ismail, Jeffery and Van Belle (2011), an overall lack of awareness seems to exist amongst South African SME owners/managers with respect to ICT technologies in itself, as well as knowledge about the benefits that ICT can yield and who to turn to for help with regard to systems analysis, design and building an actual system for their needs.

Previous studies also support the findings that immediate ROI is seen as a priority for SMEs and it is perceived that this is not something that ICTs can provide. Sorensen and Buatsi (2002), as well as Scupola (2003) have found that small businesses require short term ROI and ICT is seen as a long-term investment. This observation further supports the findings of MacGregor et al. (2002) who argue that SMEs need to see an immediate return on investment (ROI), whereas ICT is a long-term investment.

In conclusion, Hypothesis 5 is accepted and the findings of this research are well supported by the relevant academic literature.

5.8 Discussion pertaining to Hypothesis 6

> **H6: Owners/managers with a higher education level have a higher ICT adoption rate within their business**

Education is a key variable, which facilitates an understanding and appreciation of new technologies. Highly educated people are more adaptive and there is a direct relationship between perceived usefulness and perceived ease of use. Hence, the study sought to establish the level of education of the

respondents and whether this affected their ICT use. Thus, Hypothesis 6 aimed to see whether level of education has a direct influence on owners/managers' ICT adoption. Through the use of the linear regression model and correlation coefficients, this was found to be statistically significant.

The results of each of the linear regression models indicated that there is a significant relationship between level of education and ICT adoption for general-use and production-integration ICTs. Furthermore, the production-integrating ICTs show the strongest correlation (0.3212226) to level of education. This supports the findings by Chibelushi (2008) and Chewet al. (2010) who state that a person's education level plays a major role in the adoption of ICT in their businesses. The higher the individual's level of education, the more likely they are to have a greater level of ICT adoption. A study conducted by Basant et al. (2006) also found that Brazilian SMEs that had employees with higher levels of education were more inclined to adopt ICT. Similarly, Mokaya and Njuguna (2012) found that the level of education of Kenyan owners/managers influenced ICT adoption and that those who had at least a college level education and made use of ICT tools were more likely to use ICT on a consistent basis.

Education and training is viewed as being crucial to addressing the lack of readiness of SMEs in adopting and developing their electronic business capabilities (Chau, 2001). One may infer from this that higher levels of education may lead to higher ICT adoption rates due to formal education on business management and resources available, and/or greater awareness of ICTs.

Evidence was therefore found to support Hypothesis 6.

5.9 Conclusion

In this chapter, the results of this research were explained in terms of the findings, either drawing parallels or with or contrasting it to the existing literature. In summary, evidence was found to support Hypothesis 1, namely that SMEs perceive there to be value in ICT applications in their businesses. Hypothesis 2 was also supported as there is a significant link between perceived value and ICT adoption. Hypothesis 3 was accepted from the descriptive statistics and is in line with numerous literature that highlights that SMEs often make use of general ICTs rather than more advanced ones. However, the results pertaining to hypotheses Hypothesis 4 did not display sufficient significance for the hypotheses to be accepted. Despite the lack of infrastructure having an impact on ICT adoption, this was shown not to be statistically significant. Surprisingly, and in contradiction to existing literature, external barriers were found not influence ICT adoption. With regard to hypothesis Hypothesis 5, evidence was found to support this, with numerous studies showing that internal barriers – particularly immediate ROI and a lack of existing hardware – are common barriers for SMEs. The study showed that cost and time constraints are also clear barriers and these two can be closely linked to the aforementioned. Lastly, Hypothesis 6 aimed at ascertaining whether or not levels of education have a direct influence on owners/managers' ICT adoption. Through the use of the linear regression model and correlation coefficients this was found to be statistically significant and was accepted. This hypothesis was also supported by existing literature which shows that as people become better educated, they have more knowledge of ICT applications and access to resources to facilitate the use of these.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This final chapter examines the conclusions of the study with reference to the context set out at the beginning and highlights key differences with other research that has emerged. The research findings are related to existing theory and recommendations are made to SME practitioners and policy makers. Suggestions for further areas of exploration and future research are then presented.

6.2 Conclusions of the study

Earlier studies on ICT adoption have shown that SMEs in developing countries have not fully taken advantage of technological developments to extend their businesses beyond traditional borders (Humphrey et al., 2004). Hence, there is a need for a better understanding of the determinants of ICT usage and factors that drive or constrain its adoption and use (Harindranath et al., 2008).

The variance between adoption patterns in developing and developed countries focuses on support activities needed in the development. Support is available in developed countries and it is mostly a matter of finding the appropriate assistance for an SME encountering barriers, whereas in developing economies this support is almost non-existent. The objectives of this study were to understand which ICTs are currently being used by SMEs, and also to understand and determine the various internal and external barriers to ICT adoption. This study revealed that internal barriers, such as immediate ROI and lack of existing hardware, significantly hinder ICT adoption by SMEs. Lack of infrastructure is another external barrier that impacts ICT adoption highlighted by the respondents.

This study provides an understanding of the challenges faced by SMEs in the adoption of ICT in developing countries- specifically that of South Africa. The results of the questionnaire clearly indicate the necessity to provide support for SMEs if they are to successfully adopt ICT in order to grow their businesses and benefit the economy of the country. While the findings indicate that each SME has their own unique mix of factors which influences their adoption patterns, one can see that there are significant internal barriers that determine the level of ICT adoption by South African SMEs. These findings contribute to the knowledge on how South African SMEs can be encouraged to adopt ICTs throughout their businesses.

In summary, the questionnaire findings point out that SMEs need to think more strategically about their use of ICT. In this respect, SMEs are falling behind best practices adopted by their larger, more established counterparts in the global economy. Private and public agents charged with the development of SME capabilities also need to redirect their delivery mechanisms to address the ICT capability and information gaps identified in this research.

6.3 Recommendations

In summary, the recommendations for SMEs, policy makers and businesses to overcome barriers and improve the implementation of ICTs are as follows:

- SMEs should invest in educating their staff and management about ICT and its benefits (Mutula & Van Brakel, 2006). SMEs should establish ICT as a core area in the same way as the core areas of finance or human resources are established. In so doing they will be recognising ICT as an important function that deserves to be taken seriously. Once this key function is established, SMEs need to identify a clear terms of reference for this function and establish their specifications; i.e. to know what abilities, skills and experience they are looking for when they want to fill the roles. When looking for staff to occupy the positions, it is imperative that competent people are chosen, with the right

qualifications and experience to do the job. Owners of SMEs should also set good examples in acquiring ICT knowledge and skills and seek to motivate their employees to do the same. In order to effectively participate and compete in modern society, ICT proficiency is essential for all companies- no matter how big or small they are.

- SMEs should also consider investing in recruiting or outsourcing knowledgeable ICT specialists (Perry, 2007). However, often times the challenge is that an SME cannot afford individuals with the required skills. If possible it would then be advisable to hire a consultant in the short term to provide advice, training and a review of existing systems and opportunities available. The objective will be to get a consulting company that understands both ICT and the business aspect. Random decision-making with regard to ICT amongst SMEs is a common problem that must be addressed in order to give SMEs a competitive advantage. The ability to identify company needs and the appropriate source of support to satisfy these needs is a crucial factor to the success of most businesses. Often SMEs fail to identify their business needs and also approach non-professionals for advice.

- It is recommended that SMEs look to build a culture that is innovative and favourable to technology (Martin, 2005). The owner/manager must take an active role in this process and aim to understand the benefits and the role of ICT within their business. ICT then needs to be prioritised as a functional area. Once this is done, the SME should build an ICT culture within the business by gradually ensuring that the business process is more reliant on technology and less on manual processes, and also by continually exploring all the various and newest technological options with their possible benefits to the SME. Regular communication with staff about the changes and the vision of the organisation is important to make all employees comfortable the new processes. The SME should also invest in teaching its staff about technology and encourage employees to use technology. As

recommended by Martin (2005), successful Internet adoption depends on different roles being set out.

- Through this research and based on previous literature, it is clear that there is a greater need for SMEs and government institutions to cooperate in addressing the barriers to ICT adoption and sustained use. Organisations must ensure the readiness of their employees for the change that is brought about through ICT solutions. This should not only be restricted to their employees, but should also recognise the multiplicative effect of appropriate ICT adoption throughout the supply chain. Infrastructure development needs to take place to complement the development of SME-based commerce. The cost of these undertakings should be considered in light of the considerable importance of SMEs to the economy.

- Governments and private roles should be strengthened to improve basic ICT skills and frameworks should be developed to encourage greater ICT and e-business skill formation (including marketing, organisational, security, trust and management skills in addition to ICT skills) in conjunction with education institutions, businesses and individuals.

- The South African government, through its relevant departments, should encourage and build linkages between SMEs and large enterprises, and create learning and research institutions and environments for knowledge and technology transfer. As an example, government departments could facilitate a more widespread use of ICT uptake by small businesses, educate SMEs on the incentives available to assist them in this regard, increase the basic ICT skill level and develop a mechanism that supports programs focusing on higher level ICT skills development for businesses, educational institutions, and individuals.

- Lastly, there is a need for ICT service providers to create customised

ICT applications and packages for SMEs, which take into consideration their unique characteristics, and needs. These bespoke applications should be affordable, focus on their daily operations, offer solutions to their problems and be easy to use. There is also a need to develop more mobile-based ICT applications because these are the most owned and frequently used ICT by the SMEs, particularly in Africa.

6.4 Suggestions for further research

While the research done in this project attempts to fill some of the gaps in the existing literature, it does not address all the possible areas of research. The following recommendations are made for future research:

- In this paper, SMEs were sampled only from the Gauteng region. In order to get a more holistic view of the ICT use amongst SMEs in South Africa, SMEs from all over the country should be sampled. This will give the researchers a more accurate representation of South African SMEs and their ICT use. Also, only 81 responses were received for this research. In order to illicit more holistic, meaningful results, it is recommended that the sample size be increased.

- The sample used in this study was only of the manufacturing sector, particularly because it is a potentially high growth sector. An analysis of various sectors of the South African economy could reveal interesting results.

- Researchers should try make comparisons of Ict use amongst developing nations, particularly those in Africa. Studies can focus on various aspects, such as simularities and differences between these countries' adoption of ICT, technological barriers, cultural barriers and opportunities, as well as policy issues.

- Future research should be done on SMEs from differing sectors in urban and rural South Africa in order to make comparisons of what the constrainsts and succeses are.

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APPENDIX A: RESEARCH INSTRUMENT

A. General Information (MCQ)

Q1 How many employees are there in your organization?

○ 1-10
○ 11-25
○ 26-50
○ 51-100
○ >100

Q2 Years in operation?

○ <1
○ 1-3
○ 4-5
○ 6>

Q3 Type of Industry

○ Food, beverages and tobacco
○ Textiles, clothing and leather goods
○ Wood and paper; publishing and printing
○ Petroleum products, chemicals, rubber and plastic
○ Other non-metal mineral products
○ Metals, metal products, machinery and equipment
○ Electrical machinery and apparatus
○ Radio, TV, instruments, watches and clocks
○ Transport equipment
○ Furniture; other manufacturing
○ Other (Please specify):

Q4 What is your highest level of education

○ Primary school
○ Secondary/High school
○ Certificate/Diploma
○ Bachelor degree

○ Honours degree
○ Master's degree or higher

Q5 What is your current position in the firm?

○ Owner
○ Manager
○ IT
○ Other (Please specify):

B. Information and Communication Technologies in Use

Please indicate with a (X) which of the following ICTs you have implemented in your organisation:

	ICT in Place	Intend To	No Intention
General-Use ICTs :			
VoIP			
Internet Access and email			
Telephone (landline)			
Fax			
Production-Integrating ICTs:			
Enterprise Resource Planning System			
Customer Relationship Management System			
Supply Chain Management System			
Intranet			

Open Source Software			
Mobile Payment System			
Finance & Accounting Software			
Document management software (DMS)			
Inventory management software			
Cloud Computing			
Market-Oriented ICTs:			
Organisational Website			
Other (Please Specify):			

C. Perceived value added through ICT Use

The following questions refer to your experience with the adopted and implemented ICTs. Please mark the most relevant option:

Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5

1. Operational costs have decreased since the ICT has been adopted	1	2	3	4	5
2. I have experienced increased efficiency of tasks since ICT implementation	1	2	3	4	5
3. Our quality of service has improved due to ICT	1	2	3	4	5
4. The organization has become more effective since the adoption of ICT	1	2	3	4	5
5. The organization has become more marketable	1	2	3	4	5
6. Customer base has increased	1	2	3	4	5
7. Increased revenue since implementation	1	2	3	4	5
8. Customer satisfaction has increased	1	2	3	4	5
9. Business processes are more efficient, tasks are performed quicker	1	2	3	4	5
10. Turnaround time has improved	1	2	3	4	5
11. Organization has become more profitable	1	2	3	4	5
12. Relationships with suppliers have been improved	1	2	3	4	5
13. Stock levels are always up to date	1	2	3	4	5
14. Organizational goals are being met with more ease	1	2	3	4	5
15. Short term targets are more achievable	1	2	3	4	5

16. Product quality has been improved	1	2	3	4	5
17. Staff morale has increased	1	2	3	4	5
18. Communication within the organisation has improved	1	2	3	4	5
19. Scheduling has become more efficient	1	2	3	4	5
20. Employees are able to work from remote locations	1	2	3	4	5

D. Barriers to ICT Use

The following questions refer to the barriers your SME experienced in adopting ICT. Please mark the most relevant option:

Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5

1. Employees IT skill level was too low	1	2	3	4	5
2. ICTs too expensive	1	2	3	4	5
3. Low level of existing hardware technology in place	1	2	3	4	5

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	1	2	3	4	5
4. Organisation required immediate ROI, ICT implementation would not deliver this result	1	2	3	4	5
5. Resistance to change within the organisation	1	2	3	4	5
6. Employees satisfaction with traditional technologies	1	2	3	4	5
7. Time constraints	1	2	3	4	5
8. Lack of awareness about the benefits of ICT	1	2	3	4	5
9. Security concerns	1	2	3	4	5
10. Business partners, suppliers and customers do not make use of ICT	1	2	3	4	5
11. ICT applications are not tailored to the way SMEs do business	1	2	3	4	5
12. No access to ICT infrastructures (e.g. electricity, telephone lines etc)	1	2	3	4	5
13. Unreliable service providers	1	2	3	4	5
14. Government regulations	1	2	3	4	5

Other Barriers (Please Specify):

APPENDIX B: Consistency matrix

The purpose of the study is to investigate to what extent SMEs in South Africa are making use of ICT and the barriers to ICT adoption amongst SMEs in the manufacturing sector.

Sub-problems	Literature review	Hypotheses	Source of data	Type of data	Analysis
To understand the existing use of ICT by SMEs	DTI, 2003 Ismail et al., 2011 Jentzsch & Miniotas, 1999 SEDA, 2012 Vosloo, 1994	H3: Most SMEs make use of general-use ICTs	Online questionairre Section B Information and Communication Technologies in Use	Ordinal	Quantitative: Data from respondents of the survey will be documented, coded and processed with SPSS Statistical Package. The data will be analysed using descriptive statistics, and will include mean, standard deviation, frequencies and percentages. Will be used to elicit information on the ICT adoption patterns of the respondents.
Determine the barriers to ICT adoption and use	Arendt, 2008 MacGregor et al, 2003 Modimogale, 2008	H4: External factors are the greatest barriers to ICT adoption amongst SMEs	Online questionairre Section D Barriers to ICT	Ordinal	Quantitative: Data from respondents of the survey will be documented, coded and processed with Statistical Analysis Software (SAS).

| | Mutula & Van Brakel, 2007 Ngwenyama & Morawczynski, 2007

Vrazalic, Stern, | H5: Internal factors are the greatest barriers to ICT adoption amongst SMEs H6: Owners or managers with a higher education level have a higher ICT adoption rate within their businesses | Use

Questions 1-13 | | Logistic regression analysis will be used to evaluate factors influencing ICT adoption choices in the SME sector. Correlation analysis will be used to evaluate the relationship between owner/manager education levels and ICT adoption. |
|---|---|---|---|---|---|
| Determine value perceived from the use of ICT in South African SMEs | Porter, 1985 Porter & Millar, 1985 Selwyn, 2002 Taylor & Murphy, 2004 Wangwe, 2007 | H1: ICTs are perceived by SMEs to add value to their business. H2: Perceived value of ICT has a positive effect on its adoption and use by SMEs | Online questionairre

Section C Perceived Value Added Through ICT Use

Questions 1-20 | Ordinal | Quantitative: Quantitative data from respondents of the survey will be documented, coded and processed with Statistical Analysis Software (SAS). Correlation analysis will be used to assess the perceived value of ICT adoption on SMEs usage. |

APPENDIX C: Instrument Consent form

MM RESEARCH CONSENT FORM

Barriers to Information, Communication Technology (ICT) adoption and use amongst SMEs: A study of the South African manufacturing sector.

INFORMATION SHEET AND CONSENT FORM

Who I am

Hello, my name is Priyal Pillay and I am conducting research for the purpose of completing my MM at Wits Business School.

What I am doing

I am conducting research on identifying the Barriers to ICT adoption amongst SMEs in South Africa.

Confidentiality

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that the research is done properly, including my academic supervisor/s. (All of these people are required to keep your identity confidential.)

All study records will be destroyed after the completion and marking of my thesis.

Risks/discomforts

At the present time, I do not see any risks in your participation..

Benefits

There are no immediate benefits to you from participating in this study. However, this study will be extremely helpful to us in understanding existing barriers to ICT adoption amongst SMEs.

If you would like to receive feedback on the study, I can send you the results of the study when it is completed sometime after July 2016.

Who to contact if you have been harmed or have any concerns

The Wits Business School has approved this research. If you have any complaints about ethical aspects of the research or feel that you have been harmed in any way by participating in this study, please contact the Research Office Manager at the Wits Business School, Mmabatho Leeuw. Mmabatho.leeuw@wits.ac.za

If you have concerns or questions about the research you may call my academic research supervisor Jose Barerreira (011 907 1755/6).

CONSENT

I hereby agree to participate in research on identifying the barriers to ICT adoption amongst SMEs in South Africa. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop participating 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 in the immediate or short term.

-I understand that my participation will remain confidential.

◯ I accept