Challenges of ICT Adoption by South African SMEs:
A study of Manufacturing and Logistics Firms

Sinfree Gono (Phd Research Candidate)
School of Management, Royal Holloway University of London
Egham, Surrey
TW20 0EX, United Kingdom
Mobile: 07984845957
Email: Sinfree.Gono.2009@live.rhul.ac.uk

Dr. G. Harindranath
School of Management, Royal Holloway University of London

Dr. Gül Berna Özcan
School of Management, Royal Holloway University of London

Abstract

Objectives
This paper investigates the impact of ICT adoption and use among South African SMEs in the manufacturing and logistics sectors. South Africa is an emerging economy as seen by its recent admission to the BRICS group of countries. The manufacturing sector provides a locus for stimulating growth and use of emerging technologies in other sectors. The logistics sector is integral to the movement of goods and supply chain linkages. The study identifies key ICT attributes and explores how they influence adoption and use in Johannesburg.

Prior Work
The study draws on the Framework of e-commerce technology adoption by SMEs (Rashid and Al-Qirim, 2001) as an overarching framework along with influences from other key approaches; the diffusion of innovations (Rogers, 2003), Technology Acceptance Model (Davis, 1989) and the Resource Based View (Barney et al, 2011) that help us to understand ICT adoption and use in SMEs

Approach
The study uses both quantitative and qualitative research techniques. A total of 130 firms were surveyed (66 in logistics and 64 manufacturing) and 52 interviews conducted (46 owner-managers and the rest representing institutional representatives, academia and consultancy).

Results
Results show that the power of the supply chain drives growth and use of ICT (supply chain slavery) in addition to internally driven firms, individuals and owner-managers. Also, most SMEs studied have a high ICT skills shortage and rely on outside ICT vendors and consultants for their needs. Interestingly, cost of ICTs was not seen as a constraint to ICT adoption. There is evidence that firms in the logistics sector have to adopt government specified ICTs before trading (adoption through policy).

Implications
The RBV approach infers that the key differentiators for ICT deployment in firms reside within the internal context of an organisation. Because of the new technologies and prospects of external knowledge transfers, the study shows that capabilities that are important to the organisation may reside (externalised) outside the firm e.g. an effective ICT consultant or ICT vendor may play a role in matching firm ICT needs and organisational objectives. As an emerging economy, South Africa is primarily concerned with wider economic empowerment of the native population taking into account its apartheid past. Notwithstanding the historical past (particularly race and gender disparities), this study proposes the need to address sectoral challenges that foster competitiveness (targeted training, funding, policy and empowerment initiatives).
The study contributes to the broadening of our understanding of the impact of ICT adoption and use in SMEs especially from a firm, sector and developing country perspective. It also avails knowledge that is of use to owner-managers, researchers and policy-makers by providing insights on the two sectors and SMEs in general. Additionally, it provides current and up to date assessment of the impact of ICT on SMEs in South Africa. Critically, this calls for consolidating on existing knowledge and extend research to shed light on the transfer of specialised ICT knowledge to SMEs.

Key Words: ICT Adoption, ICT use, SMEs, South Africa, Johannesburg.

1.0 Introduction

Information and Communication Technology (ICT) use in organisations has taken centre stage more-so in SMEs where its critical role and emergent challenges has led to increased support from governments and sector organisations alike. Though there is a growing repertoire of research in this area in developing countries, including South Africa, the literature suggests the need for creating a significant targeted body of research on ICT/SMEs in developing country contexts. Furthermore, cross-sector research study is still under-researched in this context despite its existence in extant literature in other parts of the world.

Companies differ in size, location, sector, age, ownership structure, financial performance, maturity, and management style. In literature, there exists definitional differences of what constitute an SME, and this is compounded by geographical, contextual and sectoral differences. Without ignoring the idiographic nature of SMEs (Davos et al, 2013), it is ideal to clearly define an SME in context of the research. The European Commission defined an SME in terms of microeconomic characteristics, such as turnover (not exceeding 50 million euro), annual balance sheet total (not exceeding 43 million euro) and headcount (fewer than 250 persons). In South Africa, SMEs can be classified as micro, very small, small or medium enterprises (also referred to as SMMEs) with varying sets of thresholds for each individual sector. We have adopted the National Small Business Act of 1996 definition with an upper threshold of 200 employees for both study sectors and R20 million and R40 million for logistics and manufacturing sectors respectively (DTI, 2008). ICT incorporates primary digital technologies like mobile phones, computers and other digital communication media designed to collect, organise, store, process, analyse and communicate both internal and external to organisations (Ritchie and Brindley, 2005, Barba-Sanchez et al, 2007). Other researchers have defined ICT as ‘any technology used to support information gathering, processing, distribution and use’ (Beynon-Davies, 2004, 2012; Beckinsdale and Ram, 2006, 2009; Porter and Keynes, 2012).

This paper investigates the impact of ICT adoption and use among South African SMEs in the manufacturing and logistics sectors, specifically the Johannesburg SMEs. This paper draws upon the Framework of e-commerce technology adoption by SMEs (Rashid and Al-Qirim, 2001) as an overarching framework with influences from extant ICT/SME approaches to identify factors influencing ICT adoption and use. These approaches are: Diffusion of Innovation theory (DOI), the technology acceptance model (TAM), Resource-based Theory (RBT). The manufacturing sector harbours a diversity of activities and acts as a ground for owner-managers with new innovative business ideas while the logistics sector provides impetus to the functioning of the supply chain. It is on this basis that this paper acts as a means of investigating and identifying factors at play: industry/sector, firm size (as measured by number of employees and annual revenue), age of the firm as it influences ICT adoption and nature of firm relationships, training and ICT expertise and the role of the owner-manager among others. Such interrelationships and other variables were analysed to determine their impact on ICT adoption.

Based on empirical findings gained by a survey of 130 SMEs and 52 interviewees in the Johannesburg metropolitan area, this paper uses quantitative and qualitative analysis as a means of identifying the potential for relationships between variables. Data was gathered from firms on the basis of two industrial sectors (manufacturing and Logistics) in a vibrant and highest GDP contributing region (33.7%) of South Africa (www.southafrica.info). Non-parametric statistical analysis on the survey data and interview analysis transcripts suggest that impact of ICT and use cannot be
explained on the basis of single variables as it is a result of a variety of inter-relationships of multiple factors.

Admittedly, ICT/SME research in South Africa is still growing with relatively few adoption studies compared to developed countries. Of note, is a report on ICT and Entrepreneurship (Kew and Herrington, 2009), and academic studies that have recently been undertaken and provided some insights into the research context; Obstacles to the growth of new SMEs in South Africa (Fatoki and Garwe, 2010), ICT Adoption and Development of E-business among SMEs in South Africa (Mpofu et al, 2010), the Role of ICT within Small and Medium Enterprises in Johannesburg (Modimogale and Kroeze, 2011), and Investigating the key factors influencing ICT adoption in South Africa (Kyobe, 2011). Our research study specifically focused on Johannesburg, a hub of South African economic activities.

There is extensive debate in literature regarding the advantages (or disadvantages) firm location has on a business. Porter (1998) argued for the competitive advantage of clusters allowing knowledge sharing and generating innovation. The development of clusters derives from their ability to concentrate economic activities in a particular location. Critical mass helps drive further development and outstrips the abilities of individual enterprises to develop competitiveness. Owner-manager of Log 173, a specialist logistics firm commented on the benefits of location to his firm:

'We are situated in the Johannesburg (now called Oliver Tambo) airport area because there are a lot of other logistics companies, good for our exports as we are close to the airport. This area is the logistics city of Gauteng'.

While location may enable an SME to leverage itself by using local knowledge about the sector, competitors or market opportunities; Fatoki and Asah (2011) noted that ‘geographical proximity to either critical buyers or suppliers produces a form of enhanced environmental scanning that enables SMEs to more easily identify and exploit growth opportunities in the market’. Bennett and Smith (2002) view locational differences as having little relationship with competitive conditions or competitive advantage. This contradicts Porter’s argument that competition is highly locational specific but confirms the view of Dunning (1998), Rugman et al (2012) and Rugman and Hoon Oh (2012) who found that firms become competitive through specialisation, exporting or other means irrespective of location and that economic geography is now much less relevant for business strategy.

To compete in the burgeoning nature of global competition SMEs need to explore issues pertaining to their internal and external environment, technological, and individual attributes of the owner-manager. To complement existing evidence regarding these attributes, this paper applies approaches grounded in ICT/SME and innovation literature in order to analyse the impact of ICT adoption and use through answering the following research questions:

1. What is the impact of ICT adoption and use in the South African Manufacturing and Logistics sectors?
2. How are the identified attributes influencing ICT adoption and use among SMEs in the Manufacturing and Logistics sectors in Johannesburg?
3. What are the challenges confronting owner/managers of SMEs in the Manufacturing and Logistics sectors of Johannesburg, in their efforts to develop a strategic approach to the adoption and use of ICT in their businesses?
4. What internal capabilities and processes are used for managing ICT within SMEs in the Manufacturing and Logistics sectors in Johannesburg?

The paper first outlines the literature review relevant to ICT/SME literature using the adapted research framework as a guide. Then, the main results of the empirical study are presented and discussed, and finally conclusions and managerial implications are proposed.

2.0 Analysis of Relevant Literature on ICT and SMES

There is an on-going debate within and outside the academic community about the value of ICT to SMEs despite conflicting support for the significance of the factors of ICT adoption and use (Parker
and Castlemann, 2007a). Previous studies on ICT adoption report that SMEs in developing countries have not fully capitalised on technological developments to extend their businesses beyond traditional borders: off-line identification of customers, use of multiple intermediaries and marketing channels constrained by distance (Humphrey et al, 2003; Molla and Licker, 2005; Shemi and Procter, 2013). There is a need for a better understanding of the determinants of ICT usage (Taylor and Todd, 1995) and factors that drive or constraint its adoption and use (Harindranath et al, 2008; Mpfu et al, 2010). With specific reference to our context, this research aims to improve our understanding of firm, sector and country specific context of ICT adoption processes by SMEs with policy implications.

Gagnon and Toulouse (1996) ascribe the use of ICT in business as no longer a matter of choice but rather one of survival, with a better understanding of the process of adopting new technologies as both essential and urgent. Similarly, a research carried out in Portugal by Caldeira and Ward (2002) showed that SMEs that were doing well locally (i.e. in the protected home market) were losing out to outside firms that were employing more aggressive business methods and tactics and hence saw their market share eroded. A similar argument was put forward by Lawson et al (2003) attributing that organisations that do not embrace new technologies will be left behind and encourages the use of e-commerce, an idea supported by Al-Qirim (2005). Kotelnikov (2007) also suggested that SMEs 'who have not yet adopted ICT will have trouble surviving' and will lose out to competition.

The research stream examining the adoption and use of new ICT has evolved into one of the richest and most mature research streams in the information systems field (Venkatesh et al, 2003). Along the way, researchers have identified a variety of factors that affect technology adoption in SMEs and use differing models in determining reasons why firms adopt ICT (or not). Much of the earlier literature is based on Roger’s (1995) Diffusion of Innovation theory (DOI), which highlights the characteristics pertinent to the decision to adopt and diffuse information technology. Other streams focused on the acceptance of technology in organisations (TAM); perceived ease of use and perceived usefulness constructs (Davis, 1989); while other approaches focused on the internal capabilities of the firm as being essential for survival and achieving competitive advantage, the Resource Based View (Barney, 2011). Other factors put forward in literature include; cost of ICT, the role of owner-manager and their characteristics (literacy level, experience, and ICT knowledge), regulatory requirements, customer/supplier pressure, and supply chain. Goode and Stevens (2000) indicated six characteristics as consistently associated with the adoption of technology; business size, age, industry, use of an IT support unit and IT budget, and degree of technology experience. However, these factors impact ICT adoption and use differently in different contexts, hence treating SMEs as a collective entity (Parker and Castlemann, 2009) has meant that there is a lack of depth in understanding and appreciating how individual firms are impacted by the process of adoption. In this light we posit that factors influencing ICT adoption and use are complex and in many cases subjective to the SME(s) in question. With the benefit of these theories, new approaches emerged in different contexts; a framework for EC technology adoption by SMEs (Rashid and Al-Qirim, 2001) which forms the framework of our study.

3.0 Theoretical Approaches
The ICT/SME adoption and use argument is multi-pronged, hence this section gives a brief introduction to the theoretical approaches used in this study and how they relate to the framework in Figure 4.1 below.

3.1 Diffusion of Innovation
The DOI approach has its primary focus on how potential adopters perceive an innovation in terms of relative advantage/disadvantage (Rogers, 1995); hence some of the factors of the DOI approach help form our framework: innovativeness, complexity, compatibility and relative advantage. Furthermore, firms that intensely use a particular technology are often prime candidates for early adoption of the next generation of that technology (Shih et al, 2013). The diffusion of innovations approach in our study is important to understanding the dynamics at play in relation to adoption and use of ICT in SMEs. There are discourses focusing on adoption by organisations and also by individuals. These two types of adoption both play a role when investigating the diffusion and adoption of ICT by SMEs. After all, in SMEs many of the primary decisions are made by the owner-manager. The organisational decision to adopt technology becomes intertwined with personal perceptions and attitudes of the owner-manager towards that technology (Akkeren and Cavaye, 1999). Diffusion in SMEs is largely by way of interpersonal/inter-firm networks.
3.2 Resource-based Theory
Barney (2011) argues that the RBT approach has evolved from a nascent, upstart perspective to one of the most prominent and powerful theories for describing, explaining, and predicting organisational relationships. The resource-based view (RBV) of the firm as one of the research approaches has been widely used by a variety of researchers (Melville et al, 2004; Wade and Hulland, 2004; Saraf et al, 2007; Grover et al. 2009; Nevo and Wade, 2010; Duhan et al, 2010). In its original form, RBV emphasises the internal resources of the firm as the source of performance and competitive advantage, rather than the external environment. However, findings from our empirical study reveal that these capabilities (ICT expertise, firm networks, supply chain involvement etc.) could also be generated from the external context of the firm necessitated by the developments in technology. Hence, in view of this explanation, the following factors can be viewed as forming bundles of firm assets important to the firm and for inclusion in the framework: resources and capabilities, top management support, cost of ICT, human capital and networks and supply chain.

3.3 Technology Acceptance Model
The most widely employed model of IT adoption and use is the technology acceptance model (TAM) that has been shown to be highly predictive of IT adoption and use (Davis, et al, 1989; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000 and Venkatesh and Bala, 2008). TAM was designed to explain computer usage through two cognitions: perceived usefulness (PU) and attitude (PEOU) as determinants of intention (Davis et al, 1989). Hart (2010) stated the need for TAM to be integrated with other IT approaches that incorporate decision-makers' social and idiosyncratic characteristics. Though these approaches contributed to ICT/SME literature and influenced the formation of our framework, they also harbour some shortcomings. TAM is criticised for not accounting for the influence and personal control factors on behaviour, including the lack of consideration to other factors such as external influences from the environmental attributes, suppliers, customers and competitors (van Akkeren and Cavaye, 1999; Manelli et al, 2007). On the other hand, DOI fails to take into account a firm’s resources or social support to adopt new ICT. Regarding RBV approach, it mainly focuses on the internal aspects of the firm, however, as we have observed SMEs make use of their external context; their supply chain and reliance on external expertise, factors not currently addressed by the RBV.

A stream of SME/ ICT adoption literature and empirical analysis has emerged over the years in different contexts (Levy et al, 2001; Rashid and Al-Qirim, 2001; Caldeira and Ward, 2001 and 2002; Wymer and Regan, 2005; Kew and Herrington, 2009; Oliveira and Martins, 2011; Neirotti et al, 2013; Elbeltagi et al, 2013). These studies followed different research paths/streems. Our approach adapts the Framework of Rashid and Al-Qirim (2001) to the South African context. Given that the framework originally focused on a developed country (New Zealand), the application of this framework in a developing country may be required to help us study contextual factors of the sample firms.

4.0 Research Methodology
To fulfil the objectives of the study, the authors followed an explorative-interpretive approach utilising surveys and interviews as the primary data collection methods. We propose that by combining qualitative and quantitative methods in one study, research questions can be informed by both approaches and help develop rich insights into various phenomena of interest that cannot be fully understood using only a quantitative or a qualitative method (Venkatesh et al, 2013). Chin et al (2012) believe that quantitative methods can be used to explore and generate new understanding, opening the door for qualitative methods to dig deeper into the research area, as well as complement existing research (Wolf, 2001; Langmia, 2006; Mutula and Brakel, 2007; Kew and Herington, 2009; Fatoki and Garwe, 2010). This highlights the “complementarity effect” between survey and interview approaches to studying ICT. As well, complementarity (seeking elaboration and clarification) of the results from one method with the findings from the other method will enhance, expand and seek to extend the extensiveness and range of inquiry (Azorin and Cameron, 2012).

In less explored research contexts like South Africa, ICT researchers often encounter situations in which existing theories and findings do not sufficiently explain or offer significant insights into a

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1 PEOU: Perceived Ease of Use
phenomenon of interest. Mixed methods design strategies provide a powerful mechanism for IS researchers to deal with such situations and subsequently make contributions to theory and practice (Venkatesh et al, 2013). The authors suggest that in the context of this research, use of both quantitative and qualitative approaches is more appropriate as such a holistic approach can be used to investigate little-known phenomena like examining in depth complex firm relationships and the phenomenon in its natural setting (i.e. learn from owner-managers) using our adapted framework in Figure 4.1 below.

4.1 A framework for EC technology adoption by SMEs
This approach is focused on the investigation of the direct and indirect influences of technological, owner-manager/individual, organisational and environmental (TOOE) factors on the SME’s adoption process (Rashid and Al-Qirim, 2001). Based on Rogers (1995) and Tornatzky and Klein (1982) and other researchers who have used similar approaches with references to these approaches; Scupola, 2006, 2009, 2010) we deemed this approach suitable for an explorative-interpretive research in a developing country context. Importantly, for its emphasis on the importance of the owner-manager's role (Individual characteristics such as education, age, and experience have been found to strongly influence ICT adoption); the technological, organisational, and environmental contexts. Thus the framework should be based on the insights gained on ICT/SME studies that would assist in enriching our research study.

Building on the framework and various other inter-organisational approaches (DOI, TAM, and RBV) briefly highlighted above, we propose that this framework postulates that a set of TOOE factors will have synergistic effects (i.e. benefits as a result of interactions between a focal firm’s and its partner’s factors (Venkatesh and Bala, 2012) on ICT adoption within the industry/sector/supply chain context. While the traditional economic structure favours size and physical matters; the new economy is earmarked by relationships, networks and information (Tse and Soufani, 2003; Clear et al, 2013). With the rise in the number of firm networks in the new and emergent economies, these approaches do not fully capture the nuances pertinent to network participation. We propose that the key tenets of these theories are particularly relevant to the SME sector as they assist in explaining the relationship between different variables. Drawing from multiple approaches in this research study creates a balanced view of SMEs as each approach has strong explanatory power that relates to knowledge, competencies and attributes relevant both to the SMEs/ICT adoption discourse. It is from this background we argue that using all four attributes will deepen our understanding of the growing research in this context.

With the assistance of the adapted framework, insights from chosen approaches, factors from existing literature and SME idiosyncrasies, the formulated research framework presented in Figure 4.1 brings four themes together. Also this brings into light two very important attributes to SMEs: the owner-manager and the location and size of the firm in relation to our context of study.

Figure 4.1 The Research Framework (TOOE)
Use of the mixed-method approach and guided by the adapted framework above enables the extraction of contextually rich nuances that help explain ICT adoption in South Africa. Because of the uniqueness of South Africa’s economic structure (i.e. viewed as a developed and developing economy), diversity of nationalities and the richness of its geo-political history dominated by apartheid, we have added human capital, infrastructure and location, resources and capabilities and individual traits of owner-managers. Also, cross-sector analysis necessitates that firm sector be added to the framework.

4.2 Data Collection

The process is carried out in three steps. First, a sample of 500 SMEs was targeted in and around the Johannesburg metropolitan area in the manufacturing and logistics sectors. The firms were selected from Brabys business directory and the Chartered Institute of Logistics and Transport of South Africa (CILTSA) database for logistics firms. The e-mail and physical addresses and contact name were registered for proposed interviews. A total of 134 questionnaires were received, of which 130 were acceptable for analysis. The responses were composed of 66 firms (51%) from the logistics sector and the rest 49% (64 firms) were from the manufacturing sector. Second; two weeks prior to the actual fieldwork, an initial e-mail was sent out to explain the purpose of the study along with an invitation to participate. In all, we held 46 interviews (26 logistics and 20 manufacturing) as shown in Figure 4.1. The interviews were designed to be conducted with someone familiar with the organisation’s ICT adoption initiatives, preferably the owner-manager and whenever this was not possible someone at managerial/decision making level were made available.

Third, we held 6 interviews with sector institutions representatives; those in consultancy and academia (see Figure 5.1 below).

Empirical evidence of how SMEs adopt and use ICT was gathered on the basis of industry sector, firm size and age and other pertinent characteristics that help provide richer pictures of ICT adoption and use reality, thus contributing to SME/ICT debate and informed ICT investment decisions. For the purposes of this study however, firms with no employees (i.e. single operators or ‘one-man-bands’ as noted by Clear et al, 2013) have been excluded. Data was collected using survey questionnaires and semi-structured interviews. SPSS quantitative data analysis software was used to identify relationships within the data collected.
The interviews were one-to-one and face-to-face, apart from the Manufacturing, Engineering and Related Services Sector Education and Training Authority (MerSETA\textsuperscript{2}) with 2 interviewees. This organisation was established to facilitate skills development in the manufacturing and plastics industries. The interviews were varied in length depending on the interviewees’ exact circumstances and time constraints. In cases where further information or clarification was required, follow ups of telephone calls and e-mails were used. The interview schedule was structured into sections corresponding to the survey questionnaire covering all the research study constructs: organisational, technical, owner-manager and the environment. Sections or themes were necessary for the qualitative coding and analysis of data using Atlas.ti qualitative software. The open part of the interview was left for ad-hoc questions and open discussions for areas that interviewees felt needed covering.

5.0 Findings from Data Analysis

5.1 Location and Background information of Sample firms

Our research centres on SMEs in the Johannesburg metropolitan area, the most populated city in South Africa with more than 4.5 million people. Of the nine South African provinces, Johannesburg is the smallest province by land area but it is the most vibrant contributing more to the GDP of the economy than any other province. Most of the specific research locations are shown on the map below.

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\textsuperscript{2} MerSETA: Manufacturing, Engineering and Related Services Sector Education and Training Authority was established to facilitate skills development in the manufacturing industry.
The diagram above shows some of the localities that formed our research context. The percentage representation of each locality is shown in Table 3.1 below.

5.2 Sample Characteristics

5.2.1 Owner-manager

The Table below shows some characteristics of the firms studied including those of owner-managers: age, role etc.

5.2.2 Firm Characteristics

Innumerable characteristics define what an SME is and what they represent. The definition is influenced by country, industry and other variables but mainly the constraining effect of size especially using number of employees (Neirotti et al, 2013) is used. In our research study we also used annual revenue as an additional determinant of firm size. Other characteristics that have been found to influence adoption in SMEs are firm age, sector, financial resources and experience (Goode and Stevens, 2000; Clear et al, 2013). Furthermore, firm size (Neirotti et al, 2013), age and the industry of the firm have been found to significantly influence adoption of technology (Ashrafi and Murtaza, 2008; Mpofu et al, 2010).

The following table gives brief background information on our sample firms.

Table 3.1 Firm Summary Statistics
As could be observed in the table above, the highest number of survey respondents were based in Randburg (16%), followed by Johannesburg city and Kempton Park with 15% each. The rest are spread evenly across research localities. The table also shows the definitional characteristics of size (number of employees and annual revenue) and age of the firm with 75% of the firms being 10 years and above. This shows that most of them are mature firms.

The empirical data revealed a range of factors that influence firms to adopt and use ICT, and also the challenges resulting from the process of acquiring new systems for the organisation. There are several factors that affect the adoption of ICT in firms; i.e. financial resources, top management support, supply chain involvement, pressure from suppliers or customers, government policy, lack of ICT expertise and knowledge and vendor support. From these factors our analysis uncovered significant relationships tabulated in Table 5.1 and 2 below. Given in the following subsections are some of the results and findings identified.

### Table 5.1 Firm Size (i.e. revenue) vs Working relationship with large firms

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<td>10 years and above</td>
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</thead>
<tbody>
<tr>
<td>39 years or younger</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>31 - 40 years</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td>41 - 60 years</td>
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</tr>
<tr>
<td>61 - 70 years</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>61 years or over</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Not Recorded</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender of Respondent</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Source: Survey Data
Table 5.2 shows some significant relationships between variables identified through SPSS data analysis software.

Table 5.2 Significant Relationships

<table>
<thead>
<tr>
<th>Variables</th>
<th>p Values (p≤.05) = significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trading partner</td>
<td>.036</td>
</tr>
<tr>
<td>Supplier for large companies</td>
<td>.089</td>
</tr>
<tr>
<td>Purchase products from large company</td>
<td>.020</td>
</tr>
<tr>
<td>Supply chain</td>
<td>.010</td>
</tr>
<tr>
<td>Training and development</td>
<td>.046</td>
</tr>
<tr>
<td>Other</td>
<td>.142</td>
</tr>
</tbody>
</table>

Source: Author

Table 5.1 and 5.2 above show some significant relationships of the variables that formed our survey questionnaire. Some of the results are discussed singularly and others in combination in the following sections. Though the adapted framework (Figure 4.1) shows four individual themes, we are going to present the key findings of the individual variables: financial resources, management support, and human capital as representing the internal attributes of the firm.

5.2.3 Financial Resources

Many researchers examining ICT adoption in SMEs however attest to financial constraints having critical influence on SMEs’ adoption efforts. More so in developing countries, finance from friends and family is perceived to play a much more significant role than industrialised countries. In our research, however, most of the enterprises were medium SMEs hence this mode of financing featured minimally.

The lack of financial resources was not found to be a significant constraint to ICT adoption. From the perspective of the interviewees, the cost related to ICT related investments (software and hardware) was not an issue. It is also interesting to note that though most of the SMEs interviewed indicated of no financial concern, when it came to large ICT investments some expressed a need to look for external financing (Log 6, 10, 40, 135, 154, 185 and 246; Man 304, 339, 372, 440, 500). However, the firms that had internal ICT experts, such as Log 040, 072 and Man 256, 304, 307, 333, 339 and 440; they indicated a more precise idea about the percentage of expenditure that they had spent on
ICT investments and what plans regarding future investments they had. Other firms (for example Man 285) appear to bundle the ICT costs with other administrative overheads making it difficult to precisely account for ICT costs. This negatively reflects on some owner-managers as not having a clear idea about the cost of implementing ICT solutions to fit the needs of their business (Caldeira and Ward, 2002). Hence benefits to costs remained vague for such businesses with the final ICT investment being either above or lower than expected.

In both developed and developing countries SMEs have been found to be financially constrained due to lack of access to external financing. Some studies attributed this to weak and absence of well-developed institutions (Beck and Demirguc-Kunt (2006). In South Africa, this is said to be the result of inadequate policies that seek to re-balance the policies of apartheid that appear to be favouring black-owned firms. However, despite institutional and market failures and owner-managers airing their sceptical views challenging the efficacy of pro-SMEs funding policies; representatives of the support institutions insist owner-managers are not fully utilising available resources and support structures.

More generally, SMEs in many developing countries get around financing, market failures and lack of formal institutions by creating private governance systems in the form of long-term business relationships (Biggs and Shar, 2006), a factor that was clearly evident in a lot of firms studied. And also shown by a significant relationship of p<0.028 for trading partners shown in Table 5.2 and p<0.000 for purchasing from large companies. These networks help overcome most immediate financing requirements as they are assured of continued business within the supply chain network. In our study we discovered that while networks with some institutional support systems existed to help SMEs overcome deficiencies in their environment; they were perceived to have a discriminatory effect on firms that are outside the supply chain (Johanson and Vahlne, 2009). Furthermore, a firm that does not have a position in a relevant network is an “outsider.” And this has implications for the ways in which it can exploit opportunities. Johanson and Vahlne refer this as the effect of ‘outsidership’.

5.3 Management support

Management support refers to the degree to which an individual believes that management has committed to the successful implementation and use of a system (Caldeira and Ward, 2002). It is considered to be a critical factor (Sharma and Yetton, 2003) and an important antecedent of ICT adoption in SMEs (Jeyaraj et al, 2006; Duan et al, 2012). Ramdani et al (2009) believes it ensures the limited resources and technical expertise are allocated for the adoption of new technology. Most of the owner-managers interviewed revealed the critical role played by top management and their inclusion in most decisions taken within the firm evidenced by their increasing influence in primary decision making.

Extant literature reports on the key role played by the owner-manager, however, without negating his/her role, our findings reveal that the owner-manager in consultation with the top management (i.e. top-management approach) had a vital role in ICT adoption decision making (Log 6, 21, 42, 95,135,146, 173, 237, 246; Man 1, 339, 363, 440 and 455). In other SMEs, the ICT initiatives were the responsibility of the top manager(s) in consultation with the owner-manager(s) i.e. the collective participative approach (Log 20, 29, 32, 69, 95, 188, 342, Man 277, 285, 302, 454, 455, 468 and 495). In Man 468, top management and board of directors played an integral part.

‘Once the decision is made to acquire the needed ICT the top management team are fully supportive of the initiatives’ (Man, 468).

Since most of the firms in our research sample are mature SMEs, we increasingly see the delegation of authority from the owner-manager to top managers who are becoming an integral part of the firm.

5.4 Supply Chain Slavery

Outersidership: It is a firm-level concept that relates to a position occupied by a firm that does not have a position in a relevant network (Johanson and Vahlne, 2009).
The business environment is viewed as a web of relationships; a network joined by suppliers and customers. Previous studies have shown that regardless of firm size ICT investments produce more value in SMEs when they facilitate supply chain integration as opposed to solely focusing on efficiencies (Shin, 2006, Neirotti et al, 2013). With the existence of this scenario, inevitably pressure from within the supply chain (from large and strategic customers/suppliers) towards ICT adoption is more likely for SMEs given their size, resources and capabilities and less bargaining power. Our findings show a significant trading relationship between SMEs and large organisations (p<0.036) supporting the premise of supply chain collaborations. Furthermore, most these firms indicated that they are regular suppliers to large organisations and without the supply chain relationships; they would face challenging operating conditions in a mature market.

Interestingly, a Kruskal-Wallis test analysis (p<0.011) revealed that the firms with a large number of employees (medium SMEs with 100 employees and above) tend to trade regularly with large organisations than those with fewer numbers. While this shows the importance of firm size within the supply chain, Petterson et al (2003) also found firm size to have a significant impact on the pace of technology adoption. However, firm relationships within the supply chain are not always equitable with large organisations exerting influence on SMEs. This situation was evident in South Africa, a mature market as characterised by most interviewees, hence reliance on long term supply chain relationships paramount.

‘...we sell to other firms and individuals but largely we have been in partnerships that have been in existence since the last 25 years’ (Man 001, owner-manager).

The existence of long-term relationships creates a market maturity scenario where firms’ survival will depend on maintaining long term contracts, making it difficult for new entrants to compete (similar to Porter, 2008). We refer to the position SMEs find themselves in as ‘supply chain slavery’ where they are forced by the nature of relationships and desire to maintain contracts and grow their business into adopting ICT. This is symptomatic of the views aired by the IT operations manager of Log 072;

‘...the business as a whole is driven to seek new frontiers. However if we win a contract with one of the large organisations or government departments and they wish us to adopt some ICT we will streamline our systems or seek upgrades to facilitate customer demands’.

Arend and Wisner (2005), in their study of SMEs and supply chain management observed that at times a larger supplier or customer may force the SME to join the supply chain with any failure leading the larger counterpart finding another partner. ‘This may be one method for a larger firm to bully a smaller partner into a closer relationship, where the larger firm can more easily exploit the smaller partner, e.g. by learning its innovative methods (page 410).This view is supported by Kew and Herrington (2009) where SMEs see themselves as ‘submissive partners that will have to accept technological changes forced on them by larger partners’; the notion of supply chain slavery. Other researchers reached similar conclusions on the importance of network relations in SMEs: (Tse and Soufani, 2003, p. 306); Beckinsale and Levy (2004); Biggs and Shar (2006) and Neirotti et al (2013).

### 5.5 Training and Human Capital

Prior research has suggested the critical role of training in enhancing ICT adoption and use (Venkatesh and Bala, 2008). Training or skills development is not only the duty for the SME but an initiative that governments pursue. The level of education in the SME, cost of ICT and related training, and the lack of skills in the country are all factors that put weight on SMEs’ owner-managers in making decisions regarding ICT adoption. The availability of trained employees within an organisation and more so within the country facilitates the acceptance of new ICT. We found that those firms that had highly trained individuals within their firms displayed a deeper understanding and informed perceptions of new ICT (i.e. ability to evaluate what was suitable for their firms).

While other SMEs within the study sectors could and employed qualified ICT personnel (Log 44; Log 72), other owner-managers experienced shortages of qualified employees as exemplified by the manager of Man 454:

‘We lack human skills in more technical areas of the systems; if the systems “go down” we rely on external ICT provider or consultants to assist in solving the problems’.
Training has been suggested to be one of the most important interventions that lead to greater user acceptance and system success (Sharma and Yetton, 2007). Most of firms studied, however, adopted on-the-job training approach to minimise the cost (Windrum and Berranger 2002; Mpofu et al, 2010) associated with training. This was important and necessary in our study context where blacks who form the majority of employees were previously marginalised and refused formal education pre-1994.

There is also the issue of gender divide. We observe a strong association between gender and the importance of training (i.e. female owner-managers put more emphasis on training than their male counterparts (a high female mean rank) shown by a significant relationship between gender and importance of training variables; p<0.031 for chi-square and p<0.014 Kruskal-Wallis analysis result. With no significant relationship between gender and education, it appears from the analysis of interview responses of female owner-managers that they believe in training to equip staff with necessary skills (Man 454). And also critical for the smooth running of the business (Log 228) to enable them to meet firm needs.

A few firms had internal training facilities while others had enough financing to afford external training for their employees. We suggest that the role of training will be even more important in the context of complex systems (e.g. emerging CRM, EDI and other integrated systems) that are more central to employees’ work life. Owner-manager of Man 454 noted that in addition to in-house training and that provided by the ICT vendors, they also seek other external training organisations to equip their employees with the necessary ICT skills. These findings indicate that training can be used to help users develop favourable perceptions of different determinants of perceived usefulness and perceived ease of use.

Some firms reported of difficulties in finding ICT expertise, a factor that was disputed by GC1 (government consultant) noting that;

‘As regard human capital or specifically ICT staff: let’s say you cannot look for one and not find one. There may not be enough but we have a lot of qualified people to serve the industry. If you cannot get one immediately you are assured of getting someone to assist shortly. The problem we have is of the specific to the organisation hence finding someone with that specialist knowledge may take time but certainly not days’.

As ICT evolves there is an increase in the complexity of the applications and their subsequent management. One of the key reasons for training to be an important intervention is that different modes of training can be used to manipulate different determinants of ICT adoption (Venkatesh and Bala, 2008). Only with this learning and assimilation through training is the firm likely over time to achieve new capabilities and benefits that justify the innovation’s adoption (Swanson, 2010).

5.6 ICT vendor support and Availability of External Expertise

ICT vendor support refers to the expertise or technical support for sourcing, implementing and using ICT applications that a business obtains from external sources (Bradshaw et al, 2012). One benefit of having ICT knowledge in-house is better management of the relationships with ICT suppliers (this may be viewed as a competency under RBV) and also offers the firm the ability to decide which ICT is suitable for their firm. This was clearly stated by interviewees especially those who had internal expertise such as Log 044, 072 and Man 001 etc.

‘We have very capable staff capable with implementation of both in-house ICTs and those acquired off the shelf (Log, 072).

Our findings show that the main reasons for engaging external ICT consultants were a lack of ICT knowledge and skills, especially accounting knowledge which shows a positive association with ICT usage in firms and technology assessment as noted by Swanson (2010).

‘We lack qualified ICT personnel and rely on ICT vendors/providers for more technical problems/issues’(Man, 495)
5.7 Pressure to adopt ICT

An interesting observation of being part of a supply chain in a competitive environment is the pressure that some of the firms come under from their customers to use inter-organisational information systems. Some of the firms interviewed indicated that if they win a long term contract with a large organisation or government department they adopt needed ICT, streamline their systems or seek upgrades to facilitate customer demands.

Our findings show that customer and supplier pressure plays a huge role in the adoption of ICT with 63% of SMEs believing this to be true. With the exception of government guidance, all examined factors influencing adoption (employee suggestions, availability of new technologies, being part of the supply chain, ICT vendor pressure etc.) indicate that the logistics sector firms on average are influenced more than those in the manufacturing sector. This may be a result of a high homogeneity of products in the logistics sector as opposed to a wide variety associated with the manufacturing sector. It is rare in literature or in practice to find cases of a relatively small supplier suggesting the use of inter-organisational systems to its larger customers (Caldeira and Ward, 2002), with the reverse usually the case (Iacovou et al, 1995). However, the case of Log 044 and 072, who in addition to their main activities also develop software applications for the industry believe that they are mainly more innovative than their (larger) business partners.

Our findings confirm the view that SMEs are driven by the needs of their clients, consistent with earlier studies by Levy and Powell (2005) Poon and Swatman (1996) and Parker (1997), found small businesses were often forced to use ICT by large companies. While other researchers found no supplier influence on ICT adoption (Al-Qirim, 2003, Alam and Noor, 2009); the differences may be attributed to the frequency of interaction with suppliers/customers.

5.8 Adoption through Policy

Researchers have varying views on the role played by the government. Smallbone and Welter (2001) argued that “direct support measures are not the main role for government”, however, bearing in mind the legacy of apartheid in South Africa, the government of South Africa (GOSA) has a triple role in the SME/ICT environment: as a policy regulator through DTI, supporting agent (through SEDA, Business Partners, MerSETA) and telecommunications infrastructure provider (Telkom). Though this relationship should foster a beneficial relationship through formalising SMEs, encouraging ICT adoption (adoption through policy) and policy administration, at times the government has been accused of stifling competition through its interests in Telkom.

‘Cost of connectivity especially for data transfer is prohibitive as these connections are via the internet. The current bandwidth cannot support our requirements and is too expensive. Bandwidth is priced locally in Rand but is purchased from outside providers in US dollars; as a result exchange rates make it very expensive especially for us small companies’ (Log 044).

Though there is a high number of SMEs who are either not aware of the support given by the government (81%) or did not get the support; at the heart of the concerns was the complex application process. Furthermore the software implementation requirements by GOSA led to some owner-managers accusing the GOSA of placing a ceiling and preventing SMEs from operating in an open market environment. Some owner-managers were more worried about the impact of policies than with costs. Of note are the BB-BEE policies that seek to re-dress the economic past by encouraging the emergence of black-owned businesses.

On the other hand, the government encourages adoption of using ICT by enacting policies requiring firms to adopt certain technologies. Evidently, in the logistics sector freight companies are required to implement systems that are linked to the South African Revenue Services before they start operating. This concept is viewed as representing ‘adoption through policy’. However, while this practice is viewed as encouraging SMEs to adopt ICT, other owner-managers view it as a barrier as it entails more expenditure before a business even starts trading.

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4 BB-BEE: Broad Based Black Economic Empowerment
5.9 Discussions

The paper seeks to investigate the impact of ICT adoption and use among South African SMEs. The most cited influencing factors for adoption were supply chain, top management support, availability of internal ICT skills, customer/supplier pressure and affordability of investment costs.

Bradshaw et al (2012) noted that SMEs recognise that they do not have the appropriate ICT skills and abilities to select and implement major new systems thus they engage ICT vendors or consultants due to a lack of ICT competences. In general, ICT vendors can assist firms to bridge knowledge gaps related to ICT adoption and use (Delone, 1988; Nevo et al, 2007), critical for SMEs without adequate ICT expertise.

We argue that since the Johannesburg industry/sector is being viewed as a mature market, competitiveness is presumed to be intense and the importance of maintaining the strong existing links is paramount, ICT knowledge transmitted from vendors/consultants is a major driver of ICT use and productivity gains. However, the provision of these services by mediating institutions does enable user organisations to adopt complex technology without (initially) having to acquire a full range of technical knowledge in-house.

Within the context of our study, it appeared that it was unlikely that some SMEs will cease to rely on consultants as a result of resource constraints (i.e. training and lack of ability to employ qualified experts). Nevertheless, it is apparent that SMEs need to develop their ability to manage this relationship in order that their investment yield desired results (Cragg et al, 2011). Having seen that most of the SMEs studied rely on external sources of expertise for ICT (Thong, 2001; Al-Qirim, 2007), a lack of external technical support can inhibit ICT adoption in the SMEs concerned (Simpson and Doherty, 2004).

5.10 Conclusion and Recommendations

The findings identified and discussed in this paper assist in the investigation of the impact of ICT adoption and use in South African SMEs. Importantly, though relying on the themes identified in extant literature, the fieldwork led to a more detailed understanding of the context; important for the identification of causal factors of ICT adoption.

Most of the SMEs in this study did not have appropriate ICT expertise to decide on which ICT to invest in and to implement the new system. They relied on external expertise, external sources of advice and engagement of ICT consultants due to a lack of internal ICT competences. It seems that the ICT consultants compensated for a lack of competences within the SMEs (Nevo et al, 2007; Bradshaw et al; 2012). This also reflects the resource-poverty of some SMEs, a fact highlighted in extant SME literature.

SMEs were found to rely heavily on supply chain relationships. The ability to manage this relationship and keep up with developments in technology was found to be paramount. Additionally, the gap between government support and SME/ICT needs was identified. It should be noted that this study was limited to Johannesburg, an economically active metropolitan area, thus any inference and replication of the study in other areas might throw different results. The explorative-interpretive approach of this study called for a multiple-theoretical approach to identify contextually rich perspectives of South African SMEs’ ICT adoption behaviours.

Findings in this research study give a slightly different perspective that challenges extant literature which suggests the inability of SMEs to invest in ICTs as a result of limited resources: the issue of cost, the resource based view of the firm as not only internalised but externalised as a result of effective networks, existence of SMEs through supply chain relationships. Yet, only few mature, medium SMEs in our sample have exhibited to be better positioned to adopt ICT. Hence, we propose for further research into other contexts and sectors to shed light into the contextual ICT adoption peculiarities of SMEs.

6.0 Implications for Theory and Practice
6.1 Implications for Theory
The RBV approach infers that the key differentiators for ICT deployment in firms reside within the internal context of an organisation. Because of the new technologies and prospects of external knowledge transfers, the study shows that capabilities that are important to the organisation may reside (externalised) outside the firm e.g. an effective ICT consultant or ICT vendor may play a role in matching firm ICT needs and organisational objectives.

6.2 Implication for managers
From the point of view of findings and discussions, the results serve SME owner-managers for confirming the importance of developing a ‘systemic view’ on ICT that allow their firms to use ICT as an effective lever for continuous innovation in business processes.

6.3 Implications for policy
The study will act as a point of reference for policy-makers. Notwithstanding the historical past (particularly race and gender disparities), this study proposes the need to address sectoral challenges that foster competitiveness (targeted training, funding, policy and empowerment initiatives). Drawing on the views of Neirotti et al (2013), the findings call for the development of SME tailored ICT suitable for simpler organisational structures and resource constraints with a greater emphasis on SMEs viewed for their reluctance to commit to ICT budgets.

The prevalence of supply chain activities calls for policy makers to play a sustaining role in promoting supply chain integration that reduces the ability of large organisations to suppress SMEs.

6.4 Research Limitations
The study sought to investigate the impact of ICT adoption and use with the help of four identified themes in two sectors. There are other factors that may assist in explaining this phenomenon; hence attention should be paid not just to the developing country context or other sectors, but non-economic factors like the legacy of apartheid, culture, or exploration of SMEs within BRICs. However, caution should be exercised as differences might exist between sectors, provinces especially in South Africa where Johannesburg in the most economic vibrant province, hence, might not be representative of all provinces within the country.

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