

Understanding the Impact of ICT Adoption and Use in South African Manufacturing and Logistics SMEs: A Firm, Market and Regulatory (FMR) Context Perspective.

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Objectives

The purpose of this paper is to investigate the impact of ICT adoption and use in the manufacturing and logistics Small and Medium Enterprises (SMEs) in South Africa.

Prior Work

This paper extends the work presented at ISBE 2013 through the development of a new theoretical framework that brings together factors relating to the Firm, Market and the context of Regulation (FMR) and novel data analysis from our empirical research.

Approach

The paper is based on in-depth quantitative and qualitative research techniques using the FMR framework as a theoretical lens. A total of 130 firms in Johannesburg 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

The findings show that increasingly SMEs are dependent on their association with large organisations which had a major influence on their ICT adoption initiatives. Also, the role of government was found to be a defining factor in encouraging adoption of ICT through policy requiring firms to adopt specific technologies. The research study highlights the critical role of owner-managers and employees in South African SMEs especially in relation to their ICT expertise.

Implications

From a theoretical perspective, key findings in relation to the FMR framework enables us to have a holistic view when looking at SMEs to better understand the role played by ICT in these firms. The use of Firm, Market and Regulation perspective offers this. This model could be used by other researchers in other sectors in South Africa or in different geographical contexts to explore the impact of ICT adoption and use in SMEs.

Value

This study contributes to the SMEs' ICT adoption research in proposing and validating factors associated with ICT adoption within a developing country context using the FMR framework to highlight the criticality of the determinants of adopting ICT in South African SMEs. It also shows that in the case of developing country SMEs each individual aspect of the framework offers a necessary but not sufficient condition for the adoption and utilisation of ICT for strategic impact.

Key words: SMEs, ICT, Johannesburg, FMR, South Africa.

1. Introduction

This paper seeks to address the impact of ICT adoption by South African SMEs in the manufacturing and logistics sectors. Increasing developments in the use of ICT by firms make it imperative that we develop a better understanding of the impact of adopting such technologies by Small and Medium Enterprises (SMEs) in a developing country context. The developments in technology have resulted in a wide penetration of ICT use into different areas of businesses, including SMEs. Admittedly, most published research studies that examine factors significant for SMEs' ICT adoption initiatives come from developed economies; there is especially a lack of work exploring such issues in the South African context. Our current study seeks to address this important void. Because of the importance of the SME sector in creating economic growth, both developed and developing countries are interested in finding ways to stimulate SMEs in realising innovations.

Given the role of technology to SMEs, understanding the impact of ICT adoption and its use through a cross-sector investigation in a developing country context is important. However, adopting ICT into an existing organisational structure is often a complex and a risky strategy more-so for SMEs that are said to suffer from a lack of resources. In this context, the adoption and use of ICT is widely seen as critical for the competitiveness of SMEs in the emerging global market (Harindranath *et al*, 2008). The success of ICT adoption depends on a variety and interaction of factors, the influence of which varies among different organisations and even among different units within an organisation. The major question raised in this research study is "What is the impact of ICT adoption and use in the South African Manufacturing and Logistics sectors? Thus, the purpose of this study is to investigate not only the state of ICT in South African SMEs, but crucially the characteristics of key factors that impact ICT adoption in the context of manufacturing and logistics SMEs.

Using our formulated framework, the FMR, data gathered on the basis of firm, market and regulatory contexts should help provide a nuanced understanding of SMEs/ICT reality in South Africa. Additionally, most SMEs are characterised as being resource-constrained, using theoretical approaches like RBT that focus on firm resources and capabilities alone is inadequate especially in the context of developing economies. The FMR framework offers a more holistic approach to studying ICT issues in the SMEs in the context of developing countries like South Africa. The rest of this paper is organised as follows: First, we discuss the background literature and related concepts; a brief overview of the widely used theoretical approaches in ICT/SME research is also given. This is followed by the introduction of the research framework, a brief discussion of the methodology employed in this study, and our interpretation of the findings. We conclude with a discussion of the study's key contributions, limitations and future directions.

2. SMEs and ICT

Although SMEs form a substantial part of the business community throughout the world, developments in ICT are changing the structure of interaction between large and small and medium enterprises. Information Technology research has over the years focused on large organisations (Wang and Ahmed, 2009), and largely been conducted in manufacturing enterprises (Harland *et al*, 2007). SMEs are differentiated from larger companies by a number of key characteristics in relation to the adoption of ICT: size¹, ownership structure, revenue generated and resource-constraints.

There is no universal definition of what constitutes an SME (Mutula and Brakel, 2007); however SMEs across different countries often tend to display similar organisational and strategic characteristics. Differing SME definitions are strongly influenced by the geographic context of the research, politics and national interests. The firms studied are catalogued according to their number of employees and annual revenue with the latter having various thresholds depending on each sector. For this research study we follow the South African government's approach which defines SMEs in both sectors as having a maximum of 200 persons and an annual revenue of not more than R40 million (approximately £2.3 million for

¹ Looking at the variable size, which is frequently used for defining an SME (Clear *et al*, 2013), it is possible to find important differences across countries in order for a firm to be considered an SME. For example, the number of employees a firm must have should be less than: 250 for the EU (EU Commission, 2003), 200 for Nigeria (Apulu, 2011), 300 for South Korea (Ferreira, 2011) and 200 for South Africa (DTI, 2008).

manufacturing sector firms) and R20 million (approximately £1.1 million for the logistics sector firms) (DTI, 2008).

The ICT/SME literature has revealed some generic characteristics of SMEs that are associated with the adoption and use of ICT (Devos *et al*, 2012). A major generic finding is that the SME owner-manager has a strong influence on the organisational decision-making (Levy and Powell, 2004), direction and strategy of the business. While their capabilities may determine the rate at which the firm grows, and the fact that they ultimately make the decision on whether to adopt ICT or not, they have been found to seek support from their senior managers and external ICT consultants when adopting ICT.

Another important generic characteristic of SMEs is that of limited ICT resources and capabilities (Thong, 2001; Antlova, 2009). This resource deficit is a result of their highly competitive environments, financial constraints, lack of internal expertise, and sensitivity to external influences (Welsh and White, 1981; Devos *et al*, 2012). The shortage of internal ICT capabilities and competencies is often cited as a major reason why SMEs tend to outsource ICT and consequently rely on external ICT expertise (Dibbern and Heinzl, 2009), and their supply chain networks (Ferreira, 2011). Ongori (2009) identified some characteristics commonly identified with SMEs: lack of trained staff, owner dependence and short range management perspectives. However, though SMEs continue to operate in an increasingly complex and competitive environment dominated by large organisations, their inability to capitalise on economies of scale has led to some authors calling for these firms to increase their efforts at adopting ICT (Tan *et al*, 2010).

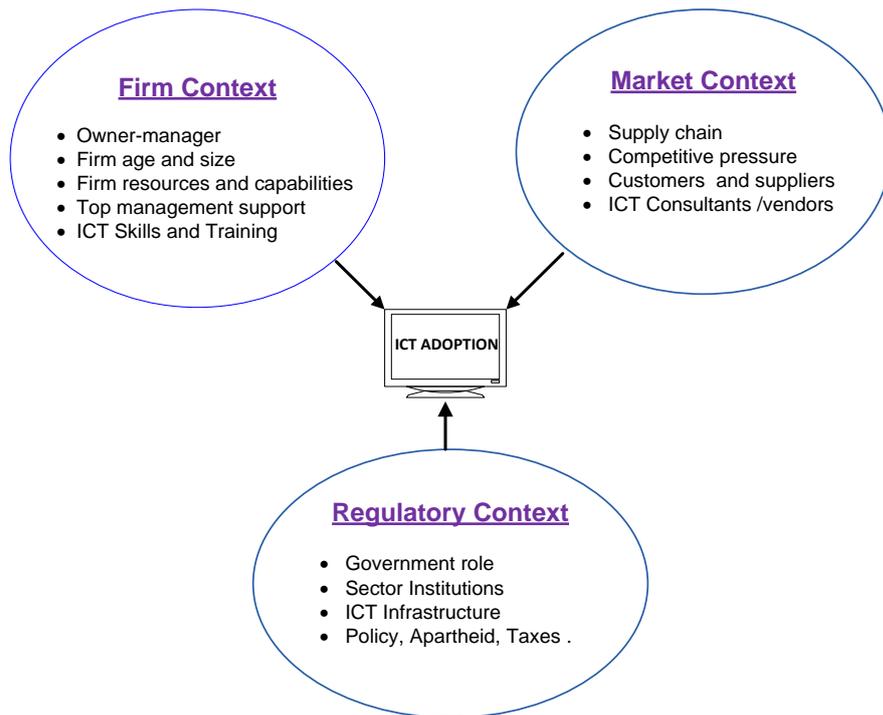
For this study, ICT is defined to include the 'technologies, hardware or software applications used to increase business efficiency, effectiveness or growth such as the internet, Electronic Data Integration (EDI), e-commerce, word processing applications, information systems, decision support systems, computer networks, mobile phones and accounting software applications'. This is similar to Beckinsale and Ram's (2006) as well as Mpofu *et al*'s (2010) definitions of ICT which state that "ICT is any technology used to support information gathering, processing, distribution and use." Similarly, Porter and Millar (1985) refer to the use of Information Technology to improve organisational processes, communications and interactions with internal and external parties to the firm. Included also are primary digital technologies for communicating both internally and externally to organisations (Ritchie and Brindley, 2005; Barba-Sanchez *et al*, 2007; and Manuelli, 2007).

3. Research Framework

The range of approaches and theoretical foci used in SMEs/ICT literature is diverse: the Diffusion of Innovations approach (DOI) (Rogers, 1995; Parker and Castleman, 2009), Technology Acceptance model (TAM) (Davis *et al*, 1989, Devos *et al*, 2012), Resource-based theory (RBT) (Caldeira and Ward, 2002; Barney, 2011) and the Technology-Organisation-Environment approach (Tornatzky and Fleischer, 1990; Scupola, 2009) are among some of the most invoked in Information Systems research on SMEs. Understanding these models/frameworks provides a lens for contextualising the relational aspects that underpin SME/ICT adoption and thus assist us in formulating the research framework for this study (Gono *et al*, 2013).

The theoretical approaches indicated above do not sufficiently capture SME/ICT realities in a developing country context, since most SMEs have access to a limited amount of resources and have a high owner-manager dependency (Ferreira, 2011). Government policy also often plays a critical role in developing countries, and markets may be underdeveloped or significantly controlled by government. As a result the FMR framework (Figure 4.1 below) integrates a variety of factors relating to the firm, market and regulatory environment thereby providing a nuanced understanding of SME peculiarities in the South African context. While the constructs in the framework might not in themselves be unique it is felt that the applicability of many of the constructs and the strength and/or nature of the relationships among the constructs might differ significantly in developing country contexts.

Figure 4.1 The FMR (Firm, Market and Regulation) Framework



Source: Author

Figure 4.1 above shows the three themes that form our framework and are discussed below:

3.1. Firm Context

The firm context is important because firm-specific competencies determine the growth and success of the firm based on its ability to create distinctive capabilities (Teece *et al*, 1997). The firm context captures top management support, ICT expertise within the firm, and firm size (Jeyaraj *et al*, 2006), and resources and capabilities (Devos *et al*, 2012) as important for ICT adoption. Effective management is a key component of running any business and this is especially true of an SME. Bathgate (2013) argues that high failure rates in SMEs are attributable to a lack of management skills of the owner-manager. As a result, unique ICT skills (competences and capabilities) are important for SMEs to gain strategic competitive advantage. From this perspective, the firm context represents the basis for internal resource management (Bathgate, 2013). These attributes represent an SME's unique set of assets: the degree of experience, competences/capabilities and skills etc. that reside in the organisation's work force. Location of firms vis-a-vis markets could also be a function of strategies and preferences of the owner-manager.

There have been differential opinions on the importance of factors residing in the internal context of the firm. Devos *et al* (2012) found that the owner-manager's knowledge and attitude to growth dominates. On the other hand, a thorough literature review of factors affecting SMEs' ICT adoption shows that the most significant factors include top management support (Ramdani *et al*, 2009), firm resources and capabilities (Dibbern and Heinzl, 2009) and internal expertise (Bathgate, 2013) as key antecedents for ICT adoption and use. Other researchers found factors such as firm size and age (Clear *et al*, 2013) assist to provide richer pictures of the firm reality and thus contribute to ICT adoption. Most of the firms are located in Johannesburg; however, because of apartheid most black people had restricted access to education, limited work experience hence most SMEs in existence are owned by the white minority. Nevertheless, one of the persisting challenges remain that of ICT infrastructure which in turn affect firm competitiveness (Modimogale and Kroeze, 2011).

3.2. The market context

The market context reflects the significance of external dependency/ties of SMEs as they are not large organisations with internal divisions. In this context, it is taken in line with the view of Coase (1937, pg. 7) to refer not to an institution but 'to such things as the number of firms' customers or suppliers and the influence of such social institutions in the facilitation of exchange. Spanos and Lioukas (2001, p. 907) viewed a firm as a "bundle of strategic activities aiming at adapting to industry environment by seeking an attractive position in the market arena" (for example, a position within the supply chain). Porter (1991) terms this position an "attractive relative position" where a firm enjoys competitive advantage. To achieve this SMEs tend to outsource their ICT functions and very seldom is an information system fully developed within the firm using the native resources of the firm (Devos *et al*, 2012). The market therefore is an important construct where specific forces play an ever increasing role especially in emerging economies that are increasingly under pressure from global demands.

The decision to adopt ICT is preceded by the intention to provide a solution to the existing needs of the organisation. To find out if these needs have been met (for example, supply chain integration) the market is the context which evaluates the potential of the technologies adopted. It considers industry structure as the primary cause of ICT adoption strategies. In the market driven perspective, of which the dominant paradigm is Porter's (1991) competitive strategy framework, the industry structure determines the competitive rules, and influences the strategies that are potentially available to the firm (Teece *et al*, 1997). In Porter's view, resources are not valuable in and of themselves; rather, their value depends on how well they fit industry structure and how well they support a particular strategy. In contrast with this perspective, the resource-based view sees resources as inherently valuable, and contends that the firm's unique resources should define the essence of strategy (Spanos and Lioukas, 2001, p. 910). This discussion is important in understanding the South African market context; since the end of apartheid large organisations have been investing in the country formerly operating a closed economy. These firms play a significant role in influencing SMEs' ICT adoption through supply chain interaction.

3.3. Regulatory context

The regulatory context plays a significant role as government policies may often affect the competitiveness of SMEs, especially so in the context of countries like South Africa. Regulation affects competition, industry structure, and preferable access (for example, ICT policies). Changes in global economies have compelled governments to re-evaluate and redefine the role of SMEs to derive the maximum growth benefits from the global environment (ECA Report, 2000). Emerging economies are encouraging growth of SMEs through support and policies as they have become competitive creators of jobs and economic growth. According to Mutula and Mostert (2010), the South African government has put in place several policies and regulatory frameworks and ICT infrastructure projects in order to enhance service delivery. The South African government's policies in relation to ICT are founded on two major pillars: ICT access and ICT as a key driver of economic and social development.

The current government's SME policy initiative was first outlined in a 1995 White Paper and, since then, various measures have been implemented to assist the development of the sector. One such policy was the creation of the Broad-Based Black Economic Empowerment (B-BBEE) as a vehicle to empower previously disadvantaged blacks to allow them full participation in the economic activities of the country. Through the B-BBEE, the government will have the ability to assist SMEs in accessing capital (Falkena *et al*, 2002). Around the globe including South Africa, there are clear attempts to incentivise and support SMEs through regulatory and policy frameworks as governments are fast recognising the value of these forms of businesses and their contribution to national economies. Particular policy emphasis has been placed on the adoption and use of ICT by SMEs. However, there is an ongoing debate about the impact of regulation on SMEs. Typically, regulation is seen as a burden or cost that adversely affects firms and, in particular, the operating efficiencies of SMEs. Such considerations of regulation though beneficial are often hampered by 'red tape' as a burden on SMEs and a constraint on competitiveness: government taxes and the cost of

regulatory compliance, insufficient demand to use SME products and services especially where B-BBEE limits access to government contracts and tenders and B-BBEE requirements.

In this section we discussed the FMR framework that integrates a variety of factors covering the firm, market and regulatory context that play a role in the adoption and use of ICT by SMEs.

4. Methodology

The main objective of this paper is to explore the impact of ICT adoption and use in the South African manufacturing and logistics sectors. To explain the impact of ICT adoption by SMEs, it is necessary to understand the perspectives of owner-managers and other actors involved in the process of ICT adoption and use by the firm. Using semi-structured questionnaires, a survey research was undertaken in 130 SMEs operating in the Johannesburg manufacturing and logistics industries. The data gathered from the respondents were structured and coded in a consistent way using SPSS software for analysis using two non-parametric statistics: Kruskal-Wallis and Chi-Square tests. In addition, a total of 52 semi-structured interviews were conducted with owner-managers, top managers, sector representatives and those in academia. All interviews were based on the same structure to ensure that all the factors were addressed by each interviewee. An extensive analysis of previous literature enabled the use of previously validated measures of ICT adoption and use that are accepted by the academic community, for example, user satisfaction (Palvia, 1996), top management support (Jeyaraj *et al*, 2006), ICT training and knowledge, owner-manager etc. (Grandon and Pearson, 2004).

Each source of data generated by both methods represents an important piece in a jigsaw. The goal of the quantitative data is to provide a sense of the degree to which particular views regarding ICT adoption and use are held by owner-managers. The responses to the semi-structured questions gave the interviewees the opportunity to express their views in areas that did not lend themselves to survey questions or to amplify their comments. The semi-structured interviews were designed to allow a variety of issues to be explored in greater depth than was possible in the survey (expand on certain issues, for example their views on training, use of ICT in their firms etc.).

5. Results and Discussion

5.1. FIRM CONTEXT

The firm context is concerned with the resources and capabilities of the firm and is important in a developing country context where SMEs suffer from resource-constraints and insufficient range of technological competencies. Some of the firm statistics are given in Table 5.1 below:

Table 5.1 Firm Statistics

Description	Survey	Interviews	Total
No. of firms surveyed	64	66	130
No. of firms interviewed			46
No of institutions interviewed			4
Academia			1
Consultancy			1
Firm Activities			
Plastics	19%	20%	39%
Engineering (industrial products)	15%	6%	21%
Cabling	5%	9%	14%
Lubricants	9%	6%	15%
General logistics	27%	22%	49%
Freight, warehousing & Distribution	24%	37%	61%
Gender			
Male	101	42	143
Female	29	10	39
Ethnicity			
White	74	39	113
Black	35	11	46
Other (Indian/Mixed race)	21	2	23
No of employees			
10 or less	14	5	19
11 - 49	26	25	51
50 - 99	8	18	26
100-200	18	11	29
Age of owner-managers			
30 or younger	18	8	26
31 - 40 years	37	7	44
41 - 50 years	45	15	60
51 - 60 years	23	11	34
61 and over	3	2	5
Owner-manager's level of education			
Standard 10 or below	16%	33%	49%
Tertiary (certificate/diploma)	45%	38%	83%
Degree or above	39%	29%	68%

Source: Author

In this section we will examine owner-manager attributes, issues relating to resources and capabilities, firm size, top management support, and ICT skills and training.

Owner-manager Attributes

Review of the literature has revealed that individual characteristics of the owner-manager such as age and experience, knowledge of ICT, gender, and ethnicity are widely believed to influence ICT adoption in SMEs (Beckinsale and Ram, 2006; Manuelli *et al*, 2007). Because of their size and lack of resources, most SMEs lack specialised ICT knowledge and technical skills. This according to Elbeltagi *et al* (2013) leads to the assumption that if an SME is led by an owner-manager who lacks basic ICT knowledge, then the firm will miss out on the benefits its business could gain from ICT adoption. In this research owner-managers' level of education was found to be positively related to the use of advanced ICT in SMEs, shown by database and accounting and finance applications. Results show that 45% of the total sample

had a tertiary qualification (certificate or diploma) with 39% having a degree or above. This finding is observed to be positively influencing their decision to adopt ICT shown by positive correlation between level of education and use of accounting and finance ($p \leq 0.002$) and database application systems ($p \leq 0.030$) and other key variables shown in Table 5.2.

Table 5.2 Level of education vs attributes

Ethnicity	0.041
Government guidance	0.05
Pressure from social contacts	0.015
Knowledge of ICT application	Database (0.030) and Acc and fin (0.002) applications
ICT satisfaction	0.05
Sector applications	0.037

Significance: $p \leq 0.05$

Source: Author

The positive correlation between owner-managers' knowledge of ICT and government guidance correlates with the views of owner-managers who indicated that government guidance was least important. Of these, 63% had tertiary and above qualifications showing that owner-managers with a higher level of education view government guidance as least important. This corresponds to a study by Finmark Trust (2010) who found most of the Johannesburg owner-managers to have had progressed beyond the standard 10 (post-matric) qualification shown in Table 6.1 above. This status entails that the inhabitants of Johannesburg have better access to resources, business networks and education, with many of the owner-managers being of white ethnicity. This observation is important in light of the restricted access to education for the black majority during apartheid. The level of the owner-manager's education had a positive correlation with ICT satisfaction as most educated owner-managers reported of being satisfied with the adopted ICT and making more use of their social contacts.

Resources and capabilities

A combination of resources and capabilities influences the ability of SMEs to adopt technologies. This forms the whole thesis of the resource-based approach (Barney *et al*, 2011) to understanding the impact of adoption and use of ICT in manufacturing and logistics SMEs. Findings drawn from both the survey and interviews suggest that when combinations of resources (e.g. ICT expertise, top management support, financing skills and supply chain capabilities etc.) exist within the firm, they form the basis for ICT adoption. Critically, the firms that have the ability to match the strengths of external expertise (Log² 031, 044, 072 and, Man 304), have resources and those that had strategic firm objectives viewed the relationship with external service providers as an important capability or resource comparable to any within the firm.

'We have a very strong IT department with highly skilled individuals. We are funded internally, no problems in this regard. Operationally, we fix most of the problems that may arise..... Yes, we are well skill resourced and have the ability to implement a lot of ICTs with no need for external assistance' (Log 044 IT manager).

In this study, the importance of external expertise (via ICT consultants /vendors) was found to be a critical resource in many firms though a few firms had strong internal expertise.

Firm Size and ICT adoption

Most medium SMEs (R10–R20 and R20–R40 million categories) are also mature in terms of the number of years they have been in operation for 10 years and above. This assertion is in line with a view by Ozcan (1995) who suggested that most SMEs are believed to not surpass

² Log 001, 002 etc. stands for logistics SMEs, Man 001, 002 etc. stands for manufacturing SMEs.

5 years (i.e. growing firms), those between 5-10 years are considered to be in 'transition' and 10 years of operation in this case determines maturity and experience of ICT use (Ozcan, 1995: pg. 155). Clearly there is evidence of a direct correlation between firm size and annual revenues. These categories represent 53 firms (41%) that have been in operation for more than 10 years. The positive relationship is confirmed by the results of a chi-square test analysis which shows a significant relationship between firm revenues and firm age ($p \leq 0.000$) with values of less than 0.05 ($p \leq 0.05$) assumed to signify a significant relationship as shown in Table 5.3 below: The high revenues of the surveyed firms correlate with the comments from owner-managers who indicated no concern with regards financing of ICT initiatives. This was more reflected in the views of owner-managers who indicated no concerns regarding cost of ICT (Log 020, 044, 072, Man, 304, 334).

Table 5.3 Significant Relationships Associated with Firm Size and Age

Description	Nature of relationship
Firm revenue vs. age of the firm	$p \leq 0.000$
Firm size vs. working relationship with large org	$p \leq 0.036$
Firm size vs. trading relationship with large org	$p \leq 0.011$

Significance: $p \leq 0.05$

Source: Author

The findings shown in Table 5.3 above support conclusions drawn by Ghobakloo *et al* (2012) who showed that the size of the firm had a positive impact on ICT adoption. While age, of the firm signifies stability, size allowed agility in the competitive environment.

Top management support and ICT adoption

Top management support entails providing essential involvement and motivational aspects for the successful introduction of the innovation (Al-qirim, 2007). Findings showed owner-managers making majority of primary decisions especially those in the logistics sector. This finding might be a reflection of the complex ICT used in the manufacturing sector firms' processes hence are prone to delegating some aspects of the decision making process to expertise (with 86% of owner-managers making use of ICT vendors/consultants as sources of advice). Across both sectors, this may be a result of SMEs adopting a more formal consultative process involving senior managers and other professionals within and external to the firm seeking a more informed input as shown by the following interview comments:

'Mainly the head of that department makes the decision regarding the technologies to be used but this will be discussed with other senior managers' (Man 333 owner-manager).

It is mainly the IT manager/Finance Director. Nevertheless, all senior personnel will hold a meeting to discuss new ICT and the potential benefits to be attained' (Log 044 IT manager).

These comments show senior managers are increasingly becoming influential in the ICT adoption process. Secondary decision-makers are those that report to and need their decisions to be ratified by the owner-manager(s) and in most circumstances cannot transact on behalf of the firm without the express authority and knowledge of the owner-manager(s). Findings also showed (14%) of owner-managers delegating most of the secondary decision-making to senior managers (38%). This illustrates a shift from sole decision making attributes of owner-managers to more acceptance of senior managers taking some responsibility. It appears top managers are increasingly having a critical role to play as they make primary decisions that originally were the domain of owner-managers.

Findings in this study show top management perspectives and attitudes towards ICT adoption and use to be one of the key determining factors for ICT adoption and use in South Africa. Interviewees confirmed what has been identified by various prior studies that found top management support essential for the adoption of new technologies (Ramdani *et al*, 2009, Scupola, 2009). In many SMEs in this study, the owner-manager and other top managers

worked closely in matters that determine strategic direction of the firm. In line with the findings by Duan *et al* (2012), top managers have been noted to possess knowledge of the business and are personally involved and influential in strategic decision-making processes. Their commitment was paramount to convince the team to adopt and use ICT, hence consistent references throughout the interviews for their support or input.

ICT Skills and Training in SMEs

The lack of ICT skills has been cited as an area of concern and remains a key challenge for many SMEs in South Africa; it has become the 'new currency' for SMEs. Having internal expertise is critical and at times makes the difference between success and failure of adoption initiatives. Across both sectors 75% of the respondents indicated that lack of training among employees was a major concern when adopted ICT did not work as expected. From the interviews conducted, it was apparent that most SMEs did not employ qualified technical people. This led to the reliance on external ICT providers who acted invariably as ICT consultants, implementers and trainers for SME owner-managers and their staff.

While most of the owner-managers interviewed value ICT training as very important, if they had to continue exploiting ICT, the cost of such training and time spent necessitates that they try and recruit qualified personnel so as to minimise training costs (Log 044).

'Training is key to our operations; however we are lucky in that the suppliers of machinery and manufacturing software are responsible for training our staff. If we think our employees need more training they are willing to train our staff. The skills are available through our suppliers and they assist with implementation and re-skilling of our employees' (Man 500 owner-manager).

Even with formal university training, SMEs continue to experience difficulties in getting the newly employed to apply their skills in a practical setting. To put this into perspective, a discussion with the IT manager of Log 044 spelt the challenges faced:

'...we have employees coming straight from college/university having done 3 years but have no idea what they are doing or ought to do. In the same token they are looking for a company phone etc. It just does not work...'

These findings are even similar to those in other sectors in South Africa as noted by Mpfu *et al* (2010) in their study of ICT adoption and development of e-business among SMEs in South Africa, which concluded that owner-managers perceived training to be a costly investment especially for those employees that have never received any form of formal education. Owner-managers reported investment in upgrading of in-house skills to be risky (i.e. trained employees are free to find new employment using the knowledge they have acquired).

Beckinsale *et al* (2011) noted that the lack of exploitation of internal expertise to ensure firm strategies fit with ICT adoption strategies is problematic for SMEs. However, a good match between a firm's information systems and its business strategy ensures a greater opportunity for ICT adoption success and achievement of competitive advantage.

5.2. MARKET CONTEXT

The South African market is dominated by medium SMEs and supply chain networks composed of both large organisations and SMEs.

ICT Adoption and Supply chain networks of SMEs

Results show that more than 50% of studied SMEs are in some form of trading relationship with large organisations. A further 13% and 23% trade a few times a year or once a year respectively. This trading relationship (see Table 5.3) is validated by a chi-square test result of $p \leq 0.036$ which shows there is a significant relationship between firm size and working relationship with large organisations. This was also confirmed by interviewed owner-managers. Similar results were obtained by Tan and Eze (2013) who found that "close

relationships with trading partners” is an area of business where being internet-based tended to be important.

Results show that 32% (51) of SMEs report as being regular suppliers to large organisations (i.e. supplier-pull relationship). A further 22% are frequent suppliers followed by 16% supplying large organisations on a monthly basis. Non-parametric statistics analysis shows no significant differences between sectors. However, a Kruskal-Wallis test analysis ($p \leq 0.011$) shows a significant positive relationship between firm size (with the highest mean-rank in category 100-200 employees), meaning medium-sized firms trade more and regularly with large organisations. The results confirm the findings by Patterson *et al* (2003) who identified firm size among other variables, had a significant impact on the pace of technology adoption. Though the relationship with large organisations is unbalanced, SMEs will foster it to enable them to remain in business, move stock or sell products.

The relationships analysed appear to strongly support the supplier/customer push theory to ICT adoption and development, an observation noted by Beckinsale and Levy (2004). From this perspective, clearly ICT adoption is a function of business relationships and networks hence, innovating a business to enter a supply chain is an increasingly employed concept by South African SMEs as a survival and growth strategy. Being part of the supply chain has important implications for SMEs as stated by Gare and Melin (2011) who found a strong connection between ICT use and the level of cooperation between organisations and external actors to the firm. The findings have shown an increased dependency of SMEs on long term relationships with larger organisations in given sectors.

We supply one major customer (BAE systems) and other smaller firms. We also buy from one major supplier of manufacturing machinery. We act mostly as a sub-contractor of large companies on a one-off basis’ (Man 500 owner-manager).

‘...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 director).

Long term relationships, though they give a sense of stability to SMEs they inevitably lead SMEs to be economically dependent on their larger partners for survival (Ramdani *et al*, 2009). Though the results largely showed no significant sectoral differences in supply chain relationships, firm size was found to have a significant effect within the supply chain. The main implication for South African SME owner-managers from this research study findings is that a typical firm is more likely to improve its chances of achieving growth with networking practices or supply-chain involvement than without. Consistent with these findings is the research study by Olawale and Garwe (2010) who suggested that networking can positively impact on the growth of South African SMEs. As a result, in several of the firms studied the long standing relationships between the SME/owner-manager/top managers and customers/suppliers seemed to explain why SMEs expressed satisfaction with existing ICT.

SME engagement with ICT consultants/vendors

Often referred to as ‘marriage brokers’ (Bessant and Rush , 1995), or obligatory passage points that are supposed to provide cumulative knowledge (Pozzebon and Pinsonneault, 2012), Swanson (2010) indicated that ICT consultants can be seen as bringing various complementary capabilities that help clients (SMEs) innovate and adapt to the on-going challenges of doing business.

About a quarter (25%) of the respondents indicated that pressure from vendors was the most important factor influencing adoption with 55% indicating it as fairly important. Of the total respondents, 52% are from the logistics sector. The fact that the majority of owner-managers in the logistics sector were of black ethnic background may explain why, because of lack of experience and low levels of education, they may be forced to look for external help. However, of note is a fairly high indication by the SMEs (18%) who feel no pressure from ICT vendors. This represents the firms that have ICT expertise, for example, those that developed their own ICT (Log 044, 072) and those who have highly trained ICT employees with the

ability to choose ICT suitable for their firms (Log 031, 044, 072 and Man 304). Despite the pressure from ICT consultants/vendors, in my conversations with owner-managers it appeared they were not being coerced into purchasing these systems rather they were willing participants in the process.

'We do not get influenced from outside, most of our ICT initiatives are internally driven (owner-manager and senior ICT employee). We will analyse anything to be acquired and if it is feasible we will buy or invest in the necessary ICT. As said before, we are fully ICT operational and cannot do without it. Our practices and activities are centred on a working system. Our practices are ICT focused', (Man 304 owner-manager).

Contrary to the findings by Ramdani *et al* (2013) who found external ICT support to be insignificant, the general lack of ICT expertise in South African SMEs necessitated the need to engage external ICT providers hence the positive relationship to the adoption of ICT (Bradshaw *et al*, 2012). The reason may be due to the context being a developing country.

5.3. REGULATORY CONTEXT

The regulatory context considers the government enacting policies and regulations to foster SME initiatives and also improvements to infrastructure. Government support for ICT adoption, support institutions and related ICT infrastructure within a country or region such as Johannesburg are some of the factors that impact a firm's ability to adopt ICT.

Government support for ICT adoption

The role of the government in providing infrastructure and policy is not disputable. Having gone through years of apartheid, the government is expected to play a direct and pivotal role in facilitating an infrastructure that enables SMEs to compete and allow previously disadvantaged majority to fully participate in the economy. However, the results show that 81% of the survey respondents' (105 SMEs) report of not having received any financial support from the government in relation to ICT investments. These findings mirror the interview responses with owner-managers reporting very little support coming from the government.

'...no major support apart from the import allowances we get should we wish to import some machinery.' (Man 285 marketing manager).

'...only information regarding regulations, compliance and certification. No funding or other initiative assistance was received' (Man 278 general manager).

The findings differ with those of Mpofu *et al* (2010) on the role played by the South African government who found the government to be playing a significant role in Tourism SMEs (i.e. hotels). The differences may be alluded to the government drive in that sector to the then pending 2010 world cup and the obvious reasons of using the tourism sector as a platform to sell South Africa to the world.

Surprisingly, the findings on government support by Finmark Trust (2010) who found on average 75% of small business owners in Johannesburg were not aware of government organisations that give support and advice, are not only confined to developing countries, Beckinsale *et al* (2006) found that none of the UK SMEs in their research study knew of any government schemes that supported ICT adoption. These results follow a similar trend to the research by SBP (2011) who identified complex and inaccessible financial support institutions such as the IDC with only two percent of their respondents having had accessed government funding, such as loans.

Owner-manager of Man 500 gave his view on the lack of support structures:

'...there is no support from institutions or any other organisation apart from the percentage VAT refund on machinery bought. The process for claiming VAT is simple as you can claim it immediately every two months (i.e. set-off what you owe against your refund)' (Man 500 owner-manager).

As far back as 2007, the owner-manager of a Johannesburg logistics SME expressed similar concerns regarding government support saying that 'government's small business talk is all talk and little action'. He spoke of his attempts over the years to access finance through one of government's schemes, but gave up as 60% of his time was being wasted on the search for funding (Financial Mail, 2007). This indicates long standing problems with government schemes or support initiatives where red tape hinders beneficiaries from accessing the facilities.

Industry structure

Policies and regulations affect every facet of SMEs more-so than in large organisations. In many developing countries in sectors such as telecommunications, governments have maintained its control of the industry (for example, through Telkom in South Africa). While this was expected and practiced during the apartheid era, surprisingly, even post-apartheid South Africa continues with telecommunications monopoly and this is viewed by some owner-managers as limiting full exploitation of ICT adoption: issues with speed, bandwidth, costs etc. Though deregulation appears to have favourably produced the desired outcomes of affordable communication and technology development in South Africa (Gillward, 2005), the long term objectives remain contentious as noted by the dissatisfaction of some of the interviewees with the way the government owned telecommunications operator (Telkom) provides the service.

'There is a monopoly in the provision of the telecommunications infrastructure and services. Telkom has the rights of distributing or selling data capacity to various organisations. The price and capacity are very prohibitive, hence expensive for the firm in the long run'. (IT Manager, Log 044).

Furthermore, the government in its attempt to redress the economic inequalities of the past has pursued policies that seek firms to attain a particular classification to be eligible to bid for government contracts or tenders (Reddy and Rampersad, 2013). One such policy is the broad-based black economic empowerment (B-BBEE). It requires SMEs to have attained a particular classification on the B-BBEE score card system. This has not been well received by various SMEs,

'The major problem we have is compliance with government regulations and we feel there is a glass ceiling that has been imposed on us as SMEs. The B-BBEE regulations are very prohibitive. As a result we can operate to a certain level but cannot expand our operations as we are very limited in terms of the relationships we can create and engage in because of the classification requirements' (Man 334 owner-manager).

However, such policies have been criticised with concerns over bidders that have gone through using political connections and not on the basis of merit and some firms seeking certification may claim that their secretaries, gardeners, drivers, etc., are directors. Window dressing often takes the form of Black people that are listed as shareholders, executives, or management, but who are unaware or uncertain of their role or participation within an enterprise" (Lotharingen, 2012). Empowerment policies appear not to be in isolation and country specific. A research on the determinants of electronic commerce adoption in Malaysian SMEs by Shaharudin et al (2012) noted that the pressure might also come from the government policies that make adoption of ICT compulsory when procuring government contracts.

6. Conclusion

In this study we attempted to build a novel framework that explains the impact of ICT adoption and use in South African SMEs. Focusing on answering the question regarding the impact of ICT adoption and use in South African SMEs, this study found strong evidence supporting the positive impact of a number of firm level factors such as owner-manager's level of education, top management support and the availability of internal expertise. The study highlights the critical role of owner-managers and employees in South African SMEs especially in relation to their ICT expertise.

The first critical finding is that increasingly SMEs are dependent on their association with large organisations which had a major influence on their ICT adoption initiatives. Additionally, the market context of a firm mainly influences the extent to which firms adopt and use ICT. Although prior studies have argued that the firm's internal resources are critical in view of the RBT (Barney, 1991), in a developing country context the market (for example, supply chain involvement) emerged critical for ICT adoption and use.

Second, the role of government was found to be a defining factor in encouraging adoption of ICT through policy requiring firms to adopt specific technologies. Additionally, some policies require the firms to have obtained the broad-based black economic empowerment certification; this being an attempt at including the black majority in the economic activities of the country following decades of apartheid policies.

Third, the study highlights the critical role of owner-managers and employees in South African SMEs especially in relation to their ICT expertise. Since valuable capabilities rely on individuals who may choose to join, stay or leave the firm, the search for SME solutions to South African SMEs' ICT challenges may need to focus on developing human capital rather than blanket approaches to SME support.

6.1. Implications

Overall the findings indicate that ICT has an important role to play in augmenting the effective use of the firm's resources with which they are combined. However SMEs in South Africa need to overcome numerous constraints posed by a combination of internal and external factors as depicted in the FMR framework. The originality of the FMR framework derives from its combining these three different but related viewpoints of SMEs. The study shows that in the case of developing country SMEs each individual aspect of the framework offers a necessary but not sufficient condition for the adoption and utilisation of ICT for strategic impact.

Our findings challenge the appropriateness of some of the popular theoretical approaches used to study ICT in SMEs with regard to their applicability in developing country contexts. Yet policy makers in developing countries faced with the task of crafting regulations to support SMEs' adoption efforts, often draw upon the stock of knowledge from investigation of SMEs in developed economies. We expect that the results from this study will inform scholars and policy makers on the significance of context and the triggers for ICT adoption across the firm, market and regulatory contexts. It may also help owner-managers' understanding of the relationship between various factors that impact ICT adoption in their firms. However, the pursuit of B-BBEE policies by the government stand accused of re-racialisation as the policies appear to benefit black people more than other racial groups.

6.2. Research Limitations

Any generalisation from this research should be made with caution. The main limitation corresponds to the number of firms (130) and the context of study, Johannesburg. Our sample consisted of firms in the manufacturing and logistics sectors of Johannesburg, the most economically active and resource rich metropolitan in South Africa. Thus the sample may be biased toward the two sectors and generalisations in other sectors or regions of South Africa should be done so in context. I note that the reliance on cross-sectoral data is a limitation of this study. This, while providing breadth, lacks depth. Hence, methodologies like case studies that have the capability of tracing the steps taken by firms to adopt ICT for the

purpose of creating strategic ICT-enabled resources and competitive advantage would undoubtedly help to further illuminate the discourse on ICT adoption and use in developing countries.

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