



# **Investigating the factors affecting the development of digital innovations in Zimbabwe's SMEs**

A Masters Dissertation by: Tafara Vakirayi

Supervisor: Prof. Jean-Paul Van Belle

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## Abstract

This study set out to investigate the factors affecting digital innovation development, and the relationship between these factors in the context of Small and Medium Enterprises in Zimbabwe. The research is founded on the seminal work of other scholars who have worked tirelessly to bring understanding to the contemporary phenomenon that is digital innovation. Unfortunately, SMEs in developing countries remain an under-researched and marginalised group – a gap which this explanatory research is intended to cover. The research is curious about the types of digital innovations that occur in Zimbabwe’s SMEs, the factors affecting development of these digital innovations and areas of ameliorative action for improving the digital innovation performance of SMEs. The research is guided by a conceptual model developed through a literature review and utilises both quantitative and qualitative methods to analyse data which was collected from SME business owners, managers and partners.

Although there is evidence of digital innovation in the country, the study establishes that both the innovative capacity and performance of SMEs is very low. Additionally, the results also point to a deliberate tendency to suppress the introduction of digital products by some businesses due to the prevalent market demands. Other notable outcomes include the impact of constrained financial resources on digital innovation performance, lack of knowledge management frameworks and more critically a general lack of understanding on what digital innovation is about. It was also established that culture, firm demographics and industry impact a firm’s digital innovation capacity significantly while the market and opportunities for external collaboration is a significant moderator of the relationship between digital innovation capacity and performance.

Fundamentally, this empirically grounded study represents a timely approach to technology, innovation, and intellectual integration which can be continuously enhanced to improve the narrative and comprehension on digital innovation especially in developing countries.

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## Dedication

Dedicated to the memory of my late mother Fungai

*“The digital age is irrevocably changing our world. It’s astounding to consider that we are limited only by our imaginations in terms of where technological innovation can take us and how it can be applied to uplift communities and ultimately impact every aspect of our environment, for the better.”*

-Warren Hero  
Former Chief Technology Officer  
Microsoft South Africa

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# 1. Introduction

## 1.1 Research Background and Context

Innovations in technology and its applications are key attributes of the knowledge-based economy widely regarded as the future of global trade and industry (Brinkley, 2006). In response, research has investigated how digital technologies can be leveraged to address pertinent developmental challenges across the globe especially within marginalised groups (Niebel, 2018). These research efforts are driven by the need to unlock value and improve the standard of living for urban and rural communities alike (UNIDO, 2015).

Business organisations and Small and Medium Enterprises experience an increasing need to assimilate digital technologies to create lasting and durable value for customers (Kohli & Melville, 2019). In a dynamic, fast-changing world, an organisation's survival is closely tied to its ability to find new ways of meeting customer needs (PWC, 2016). The desideratum for businesses to be disruptive in order to keep up or yield competitive advantage is imperative, and digital innovation is critical to achieve this goal (Egbetokun, Siyanbola, Olamide, Irefin, & Adeniyi, 2008).

Digital technologies and innovations are the impetus of sustainable growth (UNIDO, 2015). However, they also pose a risk of propagating social inequalities and advancing opportunities to the elite citizenry when not promoted in tandem with socio-economic objectives (OECD, 2018). For technology to be most effective it should be organic and adapted to local needs. Other types of innovations that take cognisance of a developing world context include Frugal/Jugaad, Bottom-of-the-Pyramid Innovation and Grassroots Innovation. All these attest to a common philosophical view; enhancing innovation capacity is critical for development (Mungai, Jiménez, Kleine, & Van Belle, 2019). Indeed, there is an urgent need for governments to mobilise domestic innovative potential to proffer home-grown solutions to their respective domestic challenges (OECD, 2018). The sentiment is echoed for developing countries to improve their capacity to utilise digital technologies for successful industrialisation. One critical pathway to achieve this is by empowering SMEs to adopt and pursue digital innovation, since they have taken a centre stage in the socio-economic development of many nations.

In Zimbabwe, SMEs have long acted as engines of economic growth and are regarded as the life blood of commerce and industry at large (Mudavanhu, Bindu, Chigusiwa, & Muchabaiwa, 2011). Consequently, the implementation of an effective digital innovation strategy for SMEs can yield a positive economic growth trajectory with an overarching impact on the greater population of the country. This research sought to illuminate the salient issues affecting the development of such digital innovations in Zimbabwe as literature shows that only a handful of countries and communities are involved in the creation of, and beneficiation from emerging technologies, relegating the rest of the world to consumerism and dependency (ITU, 2017). Furthermore, it is constructive to understand the types of innovations currently undertaken by SMEs in order to accurately guide remedial policy interventions (Egbetokun, Siyanbola, Olamide, et al., 2008).

## 1.2 Research Question and Objectives

Zimbabwe's economy is marred by gross negligence and fiscal challenges with its largely rural population living in abject poverty (World Bank, 2019c). The country has not realised any significant economic growth since the turn of the millennium and is ranked amongst the lowest on the global innovation index<sup>1</sup> (Global Economy, 2019). In light of this predicament, the study focused on investigating the factors affecting development of digital innovations in Zimbabwe's SMEs by addressing the following objectives:

1. Provide an overview of the state of digital innovation in Zimbabwe
2. Identify salient issues affecting development of digital innovations in Zimbabwe's SMEs
3. Provide guidance for the development, management and adoption of remedial policies that stimulate digital innovation in SMEs

These objectives were achieved by investigating the following research question:

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<sup>1</sup> The Global Innovation Index capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs (Global Economy, 2019).

## **What are the factors affecting the development of digital innovations in Zimbabwe's SMEs?**

The research question was broken down into sub-questions as follows:

1. Which types of innovation occur in Zimbabwe's SMEs?
2. What are the critical issues affecting digital innovations in Zimbabwe's SMEs?
3. What are the possible solutions to resolve emerging issues affecting digital innovations?

### **1.3 Significance of Research**

Literature shows that promotion of infant industries (SMEs) is at the core of ICT-driven economic growth and labour productivity in Europe (Ziaie, 2013). This research was aimed at investigating how Zimbabwe can benefit through the same order in pursuit of sustainable and inclusive socio-economic growth championed by SMEs. The study presents a timely approach to technology, innovation, and intellectual integration that surpasses the immediate demands of the business, and presents an empirically grounded perspective of the marginalised and under-researched groups in the context of a developing country.

### **1.4 Research Overview**

This dissertation is founded on a literature review in Chapter 2 which focuses on illustrating the global digital innovation landscape and defining digital innovation culminating in the development of a research model which was used to guide the study. Chapter 3 is focused on the research design and analysis techniques including ethics and confidentiality issues. Chapter 4 analyses the research findings using statistical methods and thematic analysis and gives a detailed narrative of the analysis results and recommendations. The dissertation is then concluded with a summary of research findings, implications, limitations and directions for future work.

## **2. Literature Review**

### **2.1 Introduction**

This study set out to investigate the factors affecting digital innovation performance, and the relationship between these factors in the context of SMEs in Zimbabwe. A good number of scholars have done a great deal of work in examining adoption antecedents, artefacts and design methods associated with digital innovations using common theories like diffusion of innovation (Al-Jabri & Sohail, 2012). The common discourse is that technology innovation is an emerging area of research with limited academic literature (Ciriello, 2018). The extent of our knowledge on the matter is still very ambiguous, and worsened by a lack of coherent research models (Kohli & Melville, 2019). Some scholars have pioneered the development of new theories and frameworks to investigate digital innovation with significant success in their own right (Hinings, Gegenhuber, & Greenwood, 2018). Their diverse effort is the foundation on which this literature review was established. The review dissected the research problem in a two-fold manner. The first section sought to establish the context of Zimbabwe, SMEs and ICT while the second section explored various theoretical frameworks, concepts and definitions used to investigate digital innovations, towards building a conceptual model for this study.

### **2.2 Context of Zimbabwe, SMEs and ICT Policy**

Zimbabwe is a low-income sub-Saharan country with a rugged economic landscape largely attributed to colonial and discriminatory policies which skewed economic fundamentals. Today, key levers of production remain disproportionately distributed among the largely rural population, living in impoverished, marginally productive areas with remote access to basic amenities. The disparate distribution of national income has contributed to a lopsided socio-economic system which favours the urban formal economy (UNESCO, 2014).

The most problematic factors for doing business in Zimbabwe include policy inconsistency, flawed monetary policy, overwhelming bureaucracy, lack of funding, poor infrastructure, neglected human resources, and inefficient tax administration and regulations which exacerbate the fiscal challenges (African Development Bank Group, 2019). There is also a

notable lack of innovation, inept management, bad debts and deep-rooted corruption in the country (Nyoni & Bonga, 2018). These indicators render the ecosystem toxic and unfit to incubate ground-breaking ideas.

Like several other African countries, SMEs in Zimbabwe are the largest contributor to the GDP with over 75% of the total labour working in the informal sector. These SMEs are the seedbeds of business growth, innovation and pillars of employment creation with the potential to successfully drive digital innovations across all industries (Nyoni & Bonga, 2018). SMEs play a central role in the evolution of industries at the macro level and growth of individual enterprises at the micro level. Even at a global scale, SMEs are at the core of driving innovation and enhancing sustainable competitive advantage of enterprises (Bayarçelik, Taşel, & Apak, 2014). Additionally, more than 63% of the workforce in the world is employed by SMEs (Berisha & Pula, 2015). Countries like China, Japan, India and France are sound examples of how SMEs can drive significant economic development. In China, SMEs constituted more than 90% of enterprises according to a 2006 survey (Liu, Li, & Zhang, 2012). Consequently, China has become one of the world's leading economies earmarked to eradicate absolute poverty by year 2020 (World Bank, 2019a).

Literature observes that SMEs have several advantages in comparison to larger enterprises. Firstly, the size of SMEs allows strategic decisions to be actioned expeditiously. This is a significant contrast to large enterprises characterised by a lot of bureaucracy (Rautela, 2018). Secondly, SMEs offer better interaction of human resources which increases opportunities for collaboration. Furthermore, SMEs are highly adaptable to their advantage in this dynamic digital age (Liu et al., 2012). Moreover, SMEs have the potential to make high-quality exclusive products at low-creation cost. There is also an empirical observation that SMEs are at a better advantage when innovating in digital technologies as compared to other sectors like pharmaceuticals and semiconductor manufacturing (Liu et al., 2012). However, SMEs remain inferior to large corporates with regards to capital, R&D capability and risk tolerance (Rautela, 2018).

There exists a universally fragmented discourse on what constitutes an SME, what metrics define the size and other characteristics of SMEs. The popular sharing is a legacy discourse heavily dominated and influenced by developed countries (Nyathi, Nyoni, Nyoni, & Bonga, 2018). The common definitions of SMEs are based on the number of employees, capital base

of the firm, market share, sales turnover and the infrastructure of the firm. However, none of the above bases are at par across industries and national boundaries (Nyoni & Bonga, 2018). This is purely because the definitions are conceived in different contexts (Berisha & Pula, 2015). The definition of SME given by ZIMRA, and adopted for this research, uses a point score based on employment levels, turn-over, and total value of assets (Appendix A).

With regards to policy, the government of Zimbabwe has committed to developing ICT infrastructure as seen in the phenomenal growth of mobile cellular and internet usage over the last decade (POTRAZ, 2018). The latest policy document seeks to unlock the potential of ICTs for “*sustainable socio-economic development in Zimbabwe*” and envisions for ubiquitous connectivity by 2020 (Government of Zimbabwe, 2016). Some key challenges facing the ICT industry include an acute shortage of skills as a consequence of low digital literacy, poor infrastructure, lack of capital and absence of a cyber security framework to ensure the security of the country’s assets in a digital environment. There is a dire need to integrate ICT into the mainstream curriculum in order to remedy some of these challenges. Furthermore, the government ought to formulate a framework for R&D to stimulate innovation and realise the full potential of ICT in entrepreneurship (Government of Zimbabwe, 2016). The government recognises the socio-economic value of SMEs through the Ministry of Small and Medium Enterprises which was first established in 2002. The ministry is tasked with enhancing efficiency, development and competitiveness amongst SMEs through people-centered policies (Bomani, Fields, & Derera, 2015). Therefore, it is in the interest of government to advance policies and strategies that stimulate the growth of the domestic SME sector (Bomani et al., 2015).

## 2.3 Defining Digital Innovation

Digital innovation is defined as “*a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT.*” (Fichman, Dos Santos, & Zheng, 2017, p. 330). It is the application of new technologies to existing business problems or practices to develop new products or provision improved services. Digital innovation is a continuous process propelled by advancements in technology (Lund, 2014). One characteristic of digital innovation is the complexity of the ecosystem in which it takes place (Nepelski, 2019), which is enabled through policy. “*Good policy should support a country’s transformation to an innovation driven economy that creates jobs, provides*

*export opportunities, and stimulates cross-cutting sectoral growth driven by ICT innovation”* (ITU, 2017, p. 3).

Digital innovations are not systematic but rather emerge from opportunities available in a digital ecosystem (Um, Yoo, Wattal, Kulathinal, & Zhang, 2013). Nambisan et al. (2017) captures three important and concurrent aspects of digital innovation. Firstly, the range of innovation outcomes is broad including new products, services, processes as well as customer experiences. Secondly, these outcomes are necessitated by the existence of able digital tools and infrastructure. Third is the management of innovation outcomes which is espoused in diffusion, assimilation and adoption of digital innovations. The latter is a widely researched aspect of digital innovations.

Digital innovations enable new products and services to emerge into the market. In hindsight the first online shopping websites were poor translations of catalogues, but now e-commerce has evolved at break-neck speed. Companies like Amazon and Walmart have disrupted the shopping landscape through provisioning cheaper goods and facilitating convenience (Nylén & Holmström, 2015). Uber, Alibaba, Netflix and Apple are some of the leading digital innovations on the global scene. One important observation is that all these companies were once start-ups hardly fitting into the SME model, but acted as conducive innovation seed-beds (Liu et al., 2012, Booyens, 2011). For innovation to take place effectively, a firm must establish an optimal balance between the internal organisational structure and the external business ecosystem. The business ecosystem is characterised by knowledge which the firm needs to acquire, assimilate and implement for economic value (Rautela, 2018). R&D is a common strategy for acquiring and managing knowledge (Booyens, 2011).

## 2.4 Digital Innovation Landscape

The 2030 Agenda for Sustainable Development which emphasises on inclusive development is anchored by 17 goals, one of which is premised on “*Industry, innovation and infrastructure.*” In this fourth industrial revolution, the United Nations has challenged member states to exploit frontier technologies to mitigate developmental impediments and create new industrial opportunities (UNCTAD, 2018). According to a recent UNCTAD report, Europe and North America are pioneering R&D in digital technologies and innovations. On the contrary, sub-

Saharan Africa has shown much disregard to the call made by the United Nations. This lag has been attributed to the inability of developing countries to learn, adopt and disseminate knowledge and technologies effectively (UNCTAD, 2018).

Literature posits that in order to bridge the digital divide, each region must be pragmatic in responding to the needs of its industries (Rissola & Sörvik, 2018). Governments must formulate specialist strategies aligned to enhancing the digital innovation capacity of domestic stakeholders (Rissola & Sörvik, 2018). One spectacular initiative from this report is the creation of digital innovation hubs. These are one-stop-shops for digital innovators to network and gain new knowledge. Digital innovation hubs can be orchestrators of disruptive innovation because they are rooted in the domestic ecosystem (Jiménez & Zheng, 2018). Domestic digital innovation hubs rectify the challenge of blanket development models imposed on developing countries by more advanced economies thereby bridging the gap between deployed technologies and the realities of context (Ziaie, 2013). Hubs play the critical role of disseminating knowledge and stimulating ideas amongst members. They also emancipate entrepreneurs and SMEs through opportunities for collaboration and better access to resources. (Jiménez & Zheng, 2018).

In Kenya a money transfer system based on mobile phone technology grew at an alarming rate since its inception in 2007. M-Pesa, as it is conventionally known, is one of Kenya's leading innovations in the last decade, and arguably one of the most successful digital innovations from Africa (Mbiti & Weil, 2011). This technology which has been touted for banking the "unbanked" is definitely a feat for homegrown solutions that meet the needs of the consumers. It has been widely extended to poor neighbourhoods and remote areas, allowing large proportions of the marginalised groups to participate in economic activity (Nan & Markus, 2019). Today, this new payment system has triggered unprecedented modernisation and innovation in the East African country to posit as Africa's innovation hub (De Beer, Millar, Mwangi, Nzomo, & Rutenberg, 2017). Kenya's economy is set to grow by a staggering 6.0% in 2020 through the contribution of infant industries (World Bank, 2019b).

The property rights issues in Ghana presented an ideal opportunity for disruptive digital innovation. Bitland, a start-up in Ghana, is now utilising blockchain technology to provide land registry services (Jun, 2018). Blockchain technology plays a functional role in addressing the challenges of sustainable development. It is postulated that nearly 90% of Ghana's rural land

is not registered in any official register. Bitland utilises a distributed ledger system to record all land transactions, thereby increasing transparency, efficiency, and improving revenue collected by government. According to a report by UNECA, blockchain and its applications can provide financial services to all levels of society, including SMEs to receive the funding they need to grow (UNECA, 2017). Domestic digital innovators like Bitland comprehend their local markets and relate to the social context, which gives them a competitive advantage and a better chance to fully address developmental challenges.

South Africa, one of the continent's leading economies and neighbour to Zimbabwe, has also been proactive in the digital innovations space (Booyens, 2011). A Cape Town-based start-up, Aerobotics, uses satellites, drones and Artificial Intelligence (AI) to help farmers manage their fields. Farmers use drones that fly over their fields with a multi-spectral camera. The images are automatically uploaded to the web and processed using AI. The resultant maps and data can identify problems, diagnose plant diseases and advise the farmer on resource optimisation. The potential of this innovation is enormous as it allows for data-driven decisions, helps to prevent crop failures and increases food security for the growing world population. This is one of many scenarios where digital innovations have been used to add significant value to agricultural, environmental, and food security planning (Nnadi, Chikaire, Egwuonwu, Echetama, & Atoma, 2012). This development is important especially because most African economies are dependent on agriculture (Munyua, Adera, & Jensen, 2009).

Contrary to the above, there are few indicators to throw light on digital innovations in Zimbabwe (Global Economy, 2019). The country has not gained international attention for any ground-breaking digital innovations, let alone from SMEs. In fact, people still line up and fill-in loads of paperwork for basic services like home affairs, which is cumbersome and time-consuming, highly dissatisfactory, fuels corruption, and bloats government expenses (Tsokota, von Solms, & van Greunen, 2017). This vicious cycle of stagnancy and regression is detrimental to Vision 2030 which aspires for a middle class economy by 2030 (Government of Zimbabwe, 2018) and the Global Agenda for Sustainable Development (UNCTAD, 2018). It is against this background that calls for policy imperatives for promoting digital innovations in Zimbabwe's SMEs can be made, substantiated by empirical evidence from this study.

## 2.5 Theoretical Framework

The research problem is an emerging area of research characterised by a lot of conceptual ambiguity and diversity (Yoo, Lyytinen, Boland, & Berente, 2010). Consequently, in order to formulate a robust conceptual model, it was pre-requisite to sift through an extensive set of previous research carried out to explore various factors relevant to digital innovations and SMEs. This was more preferable to relying on singular analytical constructs or pre-existing theories which may have grossly misconstrued the study. In this section some contemporary research around innovation theories, digital innovation ecosystems and innovation factors is unpacked.

### 2.5.1 Innovation Systems

The innovation systems framework helps to understand innovation from a policy and research perspective (Rautela, 2018). It remodels innovation from a linear model with input and output to a rather complex ecosystem where several actors interact and exchange knowledge towards socio-economic development. These actors include universities, firms and research institutes whose interactions grow overtime and enable the ecosystem to be more established (Kayal, 2008; Lundvall, 2005). As a result, innovation systems can facilitate the generation, diffusion and utilisation of technology (physical artefacts and knowledge) between different strategic groups in an ecosystem and usher economic prosperity (Jackson, 2011). Innovation systems can be national, regional, sectoral or technological (Kayal, 2008).

### 2.5.2 National Innovation System

The national innovation system (NIS) is a popular framework for analysing the flow of technology and information among people, and how this flow affects economic development in a domestic context. According to Kayal (2008), a national innovation system can be defined as a “... *set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provide the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies.*” (p. 77).

NIS underlies a systematic approach to innovative performance and economic growth (OECD, 1997). The model is emphatic on the role of institutions and collective activities to disseminate knowledge in a national economy (Rautela, 2018). The NIS model perceives innovation as a result of complex dynamic interactions between actors in the system. These actors include universities, research institutes and enterprises. An explicit understanding of the dynamics of how these actors interact is key to improving technology performance. In this model, a country's knowledge management strategy is considered to have a significant bearing on its innovative capacity (Kayal, 2008). As a result, firms in the NIS network are actively looking to acquire new knowledge and establish beneficial collaborations with other firms, universities, government departments and funding institutes (Lundvall, 2005).

Unfortunately, the national innovation systems framework is developed in advanced economies, thereby compromising its suitability for analysing technological innovation in developing countries. The underdevelopment in developing countries is evident in their lack of institutional sophistication and linkages between organisational units. Many scholars agree to the diverse, and almost chaotic, nature of innovation as carried out in different countries. The reality is that NIS will have varying impact in each of these economic environments (Kayal, 2008).

### 2.5.3 Digital Innovation Ecosystem and Stakeholder Groups

Firms do not exist in isolation but rather in ecosystems that create value chains based on the symbiotic interactions of several strategic groups to produce and use innovations effectively (Bayarçelik et al., 2014; Wang, 2009). The ecosystem comprises of two distinct economies; the research economy which is driven by research, and the commercial economy which is largely determined by the marketplace and demands of the consumers (Jackson, 2011).

An effective innovation policy must ensure the system remains in equilibrium at all times. That is to say, the supply and demand of innovations must tally their production and use. A thriving innovation system consumes resources (financial and non-financial) that it can replenish as innovation induced profits in the commercial economy. At this point, the two economies (research and commercial) exist in balanced equilibrium and show evidence of loose coupling (Jackson, 2011). One of the most important commodities flowing within the ecosystem especially between academia and industry is knowledge and skilled resources (Mercan &

Götkas, 2011). While the system is distinctly categorised, members can flow from one active category to another (Wang, 2009). The different groups that make up the innovation ecosystem are shown in Figure 1 below and fully described in Table 1.

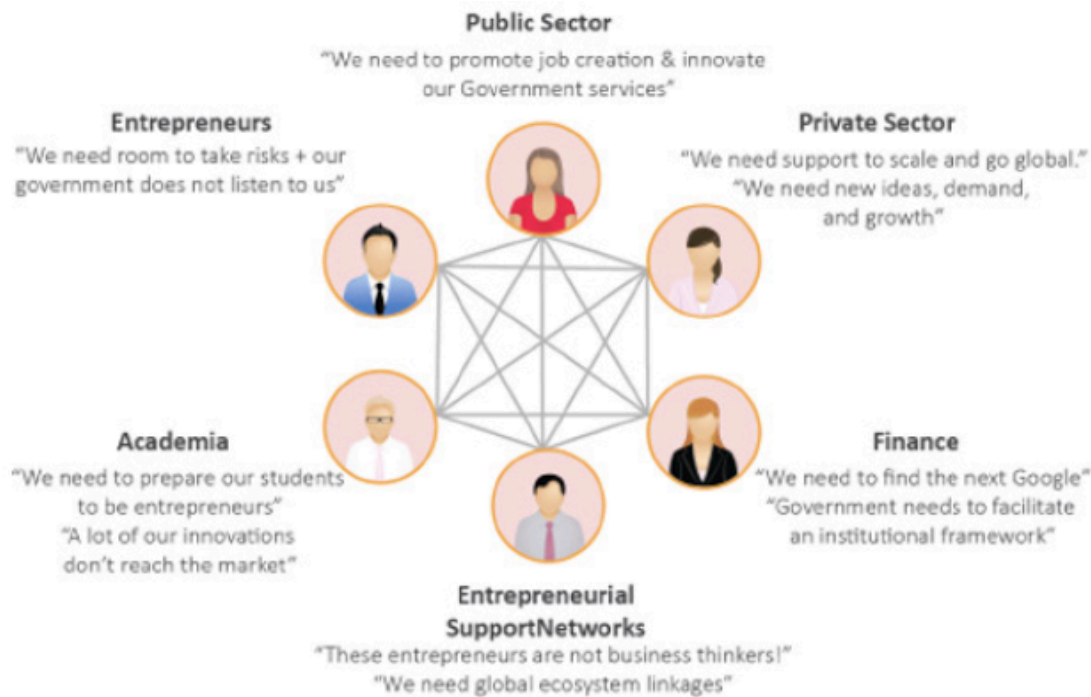


Figure 1 - Innovation Ecosystem Groups. Source: (ITU, 2017)

Group	Description
Public Sector	This group consists of government and all publicly funded agencies, enterprises and entities. This also includes policy makers, international organisations and civil society members.
Entrepreneurs	Entrepreneurs (SMEs) are the drivers of innovation as they deliver novel solutions in response to opportunities in the digital innovation ecosystem. Entrepreneurs are the champions of innovation.
Financial Actors	This group is made up of a range of investors and firms that provide financial services. They include all platforms where funding can be accessed including angel investors, crowd funding communities and NGOs
Academia	This group includes all institutions of learning at the primary, secondary and tertiary levels, as well as research institutions and training centres. Academic institutions build capacity through research & development.

Private Sector	This group involves are players that are not directly under the state such a large corporations and established SMEs, and the advocacy groups that represent their interests like chamber of commerce. These companies may, in some cases, sponsor the development of digital innovation hubs. Unfortunately, they may also sabotage digital innovations in order to safeguard their legacy systems and traditional business models.
Entrepreneurial Support Networks	This group includes innovations hubs, incubators and several other organisations that support entrepreneurs. They guide start-ups to fully matured businesses and foster community.

*Table 1 – Description of Ecosystem Groups*

#### 2.5.4 Innovation Factors for SMEs

Innovations offer new opportunities for economic prosperity (Nan & Markus, 2019), yet there is an empirical observation that the majority of firms/organisations, especially in developing countries, are inadequately innovative (Jegade, 2012). Hadjimanolis (1999) studied the barriers to innovation in an attempt to understand why a large number of organisations are adamant to introduce or adopt innovation. The research resolved that one way to effectively examine the inadequate innovation is to study the constraints or factors that inhibit innovation- that is the “barriers to innovation” approach. There is a variety of literature on barriers to innovation, however no conceptual framework that would integrate the factors acting as barriers and would permit an explanation of their combined effect, has been formulated. Another important observation about this extensive body of literature is that so far, little has been focused on in-depth understanding of the specific determinants of innovativeness in developing countries, especially in Africa (Jegade, 2012). Most scholars agree that innovation is a complex phenomenon which can be studied at various levels i.e. from individual to country level. This loosely translates to the macro and micro levels (ITU, 2017). While all levels are important for the digital innovation ecosystem, in this study they will be considered mainly in relation to SMEs. This literature review established the high-level classification scheme for thematically grouping factors affecting digital innovation. These factors are summarised in Table 2 and set the basis for the conceptual model in Figure 2.

<b>Factors affecting innovation capability</b>			
<b>Construct</b>	<b>Factors</b>	<b>Citation</b>	<b>Description</b>
Firm Demographics	Firm Size, Size + Age	(Bayarçelik et al., 2014), (Heimonen, 2012) (Talebi, Ghavamipour, & Irandust, 2012)	The size and age of the firm is considered to have a bearing on the diffusion of new knowledge which impacts innovation
Culture	Culture Factor, People and Culture, Social Networks	(Choi & Lim, 2017), (Bayarçelik et al., 2014), (Talebi et al., 2012), (Prajogo & Ahmed, 2006)	The values and beliefs cherished by a company may shape its behaviour towards innovation
Organisational Management	Management Skills, Innovation Performance, Role of Leadership, Ownership Structure, Job Tenure	(de Vasconcelos & de Oliveira, 2018), (Kim, Park, & Paik, 2018), (Bayarçelik et al., 2014), (Liu et al., 2012), (Talebi et al., 2012), (Egbetokun, Siyanbola, Sanni, et al., 2008), (Prajogo & Ahmed, 2006)	Business leaders set the trajectory of the company through strategy which may facilitate and promote innovation
Knowledge Management	Learning Capability, Innovation implementation, R&D, Managing Knowledge, Knowledge Appropriability, Industry-University Linkage	(Tsoukatos, Tabouratzi, Vassakis, & Lemonakis, 2018), (Kim et al., 2018), (Choi & Lim, 2017), (Alqahtani, 2016), (Yan, 2015), (Bayarçelik et al., 2014), (Liu et al., 2012), (Talebi et al., 2012), (Prajogo & Ahmed, 2006)	An organisation's ability to acquire new knowledge which is fundamental for innovation
Education	Education	(Sözbilir, 2018), (Choi & Lim, 2017), (Alqahtani, 2016), (Talebi et al., 2012), (Adeyeye, Jegede, Oluwadare, & Aremu, 2015)	The level of education of human resources may affect innovation capacity
Competitive Advantage	Competitive Advantage, Technological Diversification	(Haryani & Gupta, 2016), (Janaratne, 2014), (Bayarçelik et al., 2014), (Talebi et al., 2012)	A company can leverage its resources for competitive advantage

<b>Factors affecting innovation performance</b>			
Market	Market Orientation, Market Structure	(Tsoukatos et al., 2018), (Kim et al., 2018), (Bayarçelik et al., 2014), (Talebi et al., 2012)	Relates to a company's ability to forecast the market trends in order to innovate accordingly
Organisational Management	Management Skills, Innovation Performance, Role of Leadership, Ownership Structure, Job Tenure	(de Vasconcelos & de Oliveira, 2018), (Bayarçelik et al., 2014), (Liu et al., 2012), (Talebi et al., 2012), (Egbetokun, Siyanbola, Sanni, et al., 2008), (Prajogo & Ahmed, 2006)	Leaders set the trajectory of the company through strategy which may facilitate and promote innovation
Finance	Financial Factor, Financial Resource, Functional Assets and Strategies	(Tsoukatos et al., 2018), (Choi & Lim, 2017), (Alqahtani, 2016), (Yan, 2015), (Bayarçelik et al., 2014), (Talebi et al., 2012)	A strong financial base is important for innovation
Environment	Institutional Factor, Innovation Platform, Protection of IPR, Governmental and Legal Environment	(Alqahtani, 2016), (Bayarçelik et al., 2014), (Liu et al., 2012), (Talebi et al., 2012)	These factors are related to the institutional environment which affects innovation
Technology	Technology Resources	(Choi & Lim, 2017), (Bayarçelik et al., 2014), (Prajogo & Ahmed, 2006)	Digital innovations are based on the availability of able technology resources
Consumer Demands	Consumer Preferences, Demand	(de Vasconcelos & de Oliveira, 2018), (Bayarçelik et al., 2014), (Talebi et al., 2012)	Innovations may be a result of the need to meet customer needs
Networking & Collaboration	External Relationship, Networking	(Choi & Lim, 2017), (Talebi et al., 2012)	Opportunities for collaboration with other firms

*Table 2 - Innovation Factors*

## 2.6 Conceptual Model

The initial conceptual model was purely derived from literature and acted as the ‘starting theory’ for the rest of the study. An analysis of the literature, as summarised in Table 2, established that capability and performance are two distinct constituents of digital innovation. Accordingly, there are factors that impede a firm’s digital innovation capability and others that affect digital innovation performance. However, it was important to note that the factors that affect innovation performance are actually moderators of the relationship between digital innovation capability and digital innovation performance as illustrated in Figure 2 below.

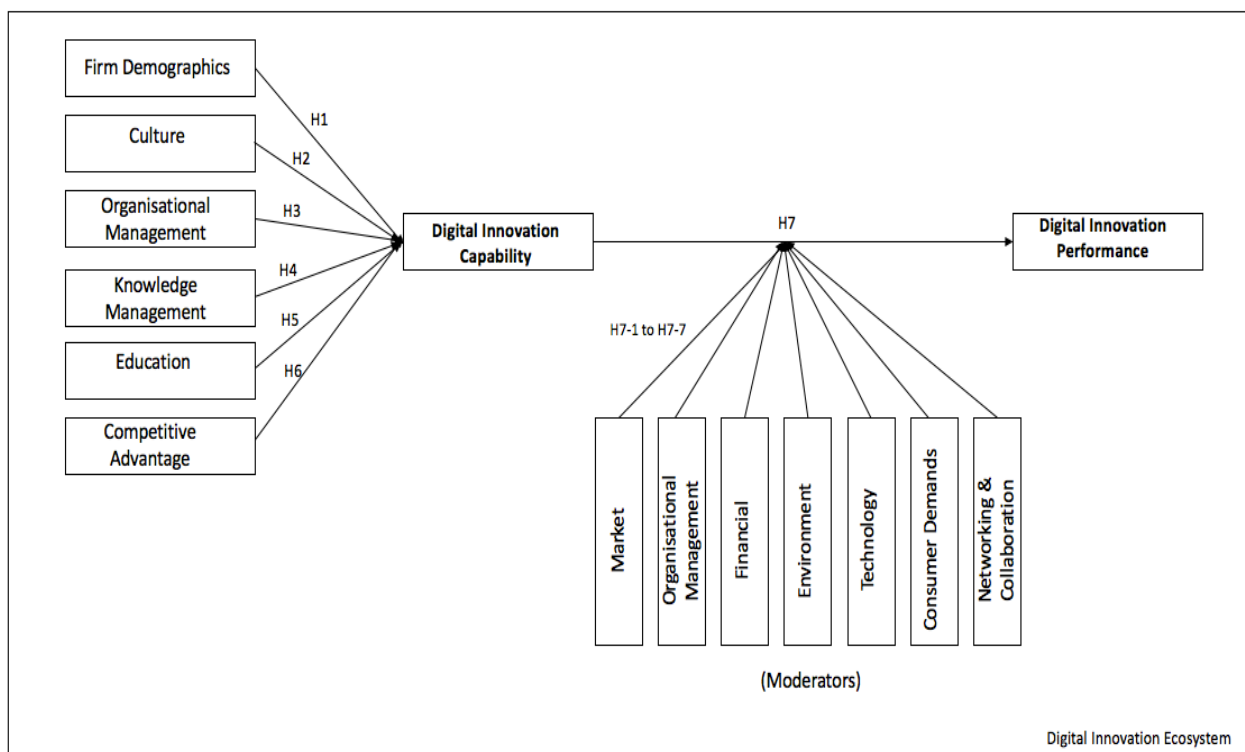


Figure 2 - Research model based on literature review

**Digital Innovation Capability/Capacity** – Innovation capacity is the overall capability of firms to generate innovation for developing new products in the direction of market demand (Janaratne, 2014; Szeto, 2000). The capacity can be incrementally or radically increased but does not directly translate to increased innovation performance. Digital innovation capacity is intangible and cannot be measured directly (Saunila & Ukko, 2012). As a result, research focuses on proxies that capture observable qualities that reflect innovation capacity (Janaratne, 2014).

**Digital Innovation Performance** – Innovation performance involves utilising innovation capacity for optimum business results through creation of new products or provision of improved services. Digital innovations in process, marketing, products, service and organisational procedures are some notable outcomes of digital innovation performance (Nambisan et al., 2017). According to literature, innovation capacity has a significant and positive impact on innovation performance (Sözbilir, 2018; Adeyeye et al., 2015). However, the translation of digital innovation capacity into actual innovation performance is affected by the moderators shown in Figure 2 as derived from Table 2. These include Market Factors, Financial Resources, the Environment and Technology Resources.

**Digital Innovation Development** – Innovation development refers to the ability of a firm to convert digital innovation capability into digital innovation performance (Sözbilir, 2018). This definition is adopted for this research.

## 2.7 Chapter Summary

The literature review managed to draw invaluable insights into the factors affecting digital innovation capacity. It also illuminated on the challenges faced by SMEs and the role of SMEs in pioneering innovation. The literature established the importance of context when researching issues of innovation using examples of other developing countries. It showed that there is a general lack of innovativeness especially amongst developing countries. The conceptual model formulated through this literature review was used to guide this study.

## 3. Research Design and Methodology

### 3.1 Introduction

This chapter discusses the research design used for this study. A research design is a procedural plan for investigating a particular phenomenon in a valid, objective, accurate and economic manner. It includes guidelines on how the researcher ought to conduct the research, including data collection, analysis and writing of hypothesis (Kumar, 2011). The research design can also be viewed as a strategy to integrate research components into a coherent and logical format. It is critical because it is significantly correlated with the researcher's questions and theories (Almalki, 2016). This chapter covers the research questions, hypothesis, philosophy, approach, strategy, sampling and timeframes. It will also cover the ethics and confidentiality considerations that affected this research, and ends with a chapter summary.

### 3.2 Research Questions

Main Research Question:

**What are the factors affecting the development of digital innovations in Zimbabwe's SMEs?**

The research question was broken down into sub-questions as follows:

1. Which types of innovation occur in Zimbabwe's SMEs?
2. What are the critical issues affecting digital innovations in Zimbabwe's SMEs?
3. What are the possible solutions to resolve emerging issues affecting digital innovations?

Sub-question 1 and 3 was done qualitatively while sub-question 2 was addressed through a quantitative survey.

### 3.3 Research Hypotheses

The listed research hypotheses were derived from the conceptual model in Chapter 2, and are intended to answer research sub-question 2.

**H1.** Firm demographics has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H2.** Culture has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H3.** Organisational management has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H4.** Knowledge management has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H5.** Education has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H6.** The need for competitive advantage has a significant effect on the digital innovation capability of SMEs in Zimbabwe.

**H7.** Financial resources (**H7-1**), the environment (**H7-2**), organisational management (**H7-3**), technology (**H7-4**), consumer demands (**H7-5**), the market (**H7-6**) and opportunities for networking and collaboration (**H7-7**) are significant moderators of the relationship between digital innovation capability and digital innovation performance for SMEs in Zimbabwe.

### 3.4 Research Philosophy

The research philosophy is primarily based on the ontological and epistemological beliefs of the researcher. Ontology is a study of how the world is made up. At its core, ontology is curious about the nature of being in relation to reality (Levers, 2013). Epistemology is about knowledge discovery; how human beings gain more insight about the reality they perceive (Wilson, 2001). The third philosophical consideration is axiology. Axiology refers to the effect of values and ethics, of both the researcher and the research participants, on the research process (Saunders, Lewis, & Thornhill, 2009).

Research philosophy has been classified into four main categories; Pragmatism, Positivism, Realism and Interpretivism (Levers, 2013). For this research, a positivist philosophy was adopted in order to gain factual knowledge supported by scientific evidence about the research phenomenon. Positivism posits that there is only one reality which should be investigated objectively using empirical data to reveal a true nature of how society operates (Wilson, 2001). This was achieved by means of limiting the role of the researcher to data collection and interpretation in an independent and objective way. The study managed to explicitly expound

the salient issues affecting the development of digital innovations in Zimbabwe's SMEs. The researcher gathered unambiguous and accurate knowledge which contributes significantly to theory (Saunders et al., 2009).

### 3.5 Research Purpose

The purpose of this research was to develop causal explanations on digital innovations in SMEs through an explanatory study that uncovered new knowledge about the phenomenon under investigation. An explanatory study was justified by the need to understand the research problem more efficiently, while taking into cognisance that very little information exists about the phenomenon under investigation especially in the context of a developing country like Zimbabwe (Saunders et al., 2009).

### 3.6 Research Approach

All research work evolves around theory even though it may not be explicitly mentioned in the research design. This theory is cardinal to the research design and is extrapolated to the reasoning approach that a researcher decides to follow. Where some related research work has been done around the subject matter, it is common for researchers to adopt the deductive approach to validate already existing theories. However, in the case of digital innovations the existing theories are premised on diffusion and not development. There is limited supporting literature to investigate the impact of causal issues in small and medium enterprises in developing countries like Zimbabwe, as intended by this research. Consequently, the abductive approach was justified based on the understanding that there is far less information in the context of this research as shown in Chapter 2. The abductive approach involved identification of themes and patterns in literature, locating these in a conceptual framework, which was tested through data collection and analysis to establish the causality relationships (Saunders et al., 2009).

### 3.7 Research Strategy

A research strategy for data collection and analysis was guided by the research questions and objectives (Saunders et al., 2009). The preliminary study used literature to establish what factors are pertinent to digital innovations and SMEs, from a global perspective to the chosen

test bed - Zimbabwe. A conceptual model was developed from this literature using thematic analysis (Braun & Clarke, 2006).

A questionnaire was used as the main instrument for the explanatory study. The questionnaire consisted of formalised and pre-specified set of questions designed to obtain responses from potential respondents (Ragab & Arisha, 2017). Surveys and questionnaires are possibly the most commonly used research instruments in the social and behavioural sciences (Kumar, 2011). The questionnaire was able to provide quantifiable answers for the research based on its implementation of Likert Scales.

### 3.8 Research Sample

In quantitative research a sample is selected to reflect the characteristics of the population from which it is drawn. The size of this sample is a fairly important consideration in quantitative study (Kumar, 2011). The researcher managed a response rate of 59% from 300 participants sampled randomly to avoid selection bias ( $n = 177$ ). Random sampling accords all cases in the target population an equal probability to be selected (Bhattacharjee, 2012). As a result, inferences from this sample can be generalisable to other similar contexts.

### 3.9 Research Instrument

The choice of research instrument for this study was largely influenced by the research strategy. As indicated in Section 3.7, the research utilised a questionnaire that was created based on the constructs of the conceptual model. Other research papers investigating the same constructs were also used in crafting the questionnaire. A sample of the questionnaire is attached in Appendix B. A pilot study was conducted to validate and corroborate the questionnaire and the results were satisfactory as all participants showed a clear understanding of the research questions based on their positive feedback and articulate responses. The questionnaire included both open and close-ended questions. The close ended questions measured each construct of the conceptual model (Figure 2) using a 5-point Likert Scale. On this scale 1 represented the lowest value while 5 is the highest value.

The questionnaire collected data in four parts. Part A which focused on the demographic data, part B for measuring the digital innovation capability of SMEs in Zimbabwe, part C for measuring the digital innovation performance of SMEs in Zimbabwe, and part D for capturing

stakeholders' qualitative recommendations and contributions based on a set of open-ended questions.

### 3.9.1 Reliability and Validity of Research Instrument

A research instrument is reliable if it is consistent and stable in reproducing the same results under constant conditions. Although it may be impossible to have a research tool which is 100% accurate, small differences in the observed outcome are acceptable (Kumar, 2011). There are four types of reliability tests namely inter-rater reliability, test-retest reliability, split half reliability and internal consistency reliability (Bhattacharjee, 2012). The research instrument for this study was checked using an internal consistency reliability test. The full results of this analysis are presented in Chapter 4.

Kumar (2011) defines validity as the degree to which a construct measures what it is intended to measure. There are three common validity tests namely face validity, concurrent and predictive validity, and construct validity. The researcher utilised the construct validity tests based on statistical procedures to ascertain the contribution of each construct to the total variance observed in the research phenomenon. The statistics were aimed at examining whether a change in the research factors leads to changes in the dependent variable. The full results of this analysis are also presented in Chapter 4.

### 3.10 Data Collection

Data was collected as guided by the research questions, over a period of six weeks following approval from the Ministry of Women's Affairs, Community, Small and Medium Enterprise Development (Appendix C). The researcher administered questionnaires online through Survey Monkey and in person to approximately 300 business owners, partners and managers of SMEs in Zimbabwe identified from official databases. However, due to resource constraints, most of the participants were in the main urban centres (Harare, Bulawayo, Gweru, Kadoma, Chegutu and Marondera). The few participants sampled in non-urban areas showed very little familiarity with the subject matter and their input was considered to be an important indicator for this research.

The researcher utilised a three-phase administration method devised by Creswell (2009). This ensured a high response rate and helped to check for non-response bias. The process included

sending a notice of intent to request the subject to participate in the survey, sending the questionnaire or handing a physical copy of it, and finally a reminder by email or phone call for the participant to complete the survey. A total of 177 responses were received, which is an outstanding figure as it has been established that the response rate for studies on SMEs is usually very low (Ajumobi, 2014).

### 3.11 Data Analysis Techniques

The research instrument collected both quantitative and qualitative data. The quantitative data based on the Likert scales was coded and analysed, using Excel, Smart-PLS, Statistica and SPSS, through a series of statistical tests which included Descriptive Analysis, Regression Analysis, Cronbach's Alpha, Kolmogorov-Smirnov, Spearman-R Correlations, Factor Analysis and Structural Equation Modelling.

Thematic analysis was used for the qualitative data obtained from the open-ended questions in the questionnaire (Braun & Clarke, 2006). The researcher identified patterns within data following a predefined procedure that involved data familiarisation, generating of codes to identify data, searching for themes, defining and naming these themes, and producing a report of the observed patterns (Maguire & Delahunt, 2017). The full analysis is done in Chapter 4.

### 3.12 Research Timeline

Due to time constraints on the master's program a cross-sectional design was used. Cross-sectional study is one of the most common designs in the social sciences discipline. This design is best suited for investigating the research question at a particular time (Kumar, 2011). This means that the observation or collection of data is performed in a single moment to create a "snapshot" of the phenomenon under investigation (Zangirolami-Raimundo & Oliveira, 2018). In this case between January and February 2020.

### 3.13 Ethics and Confidentiality

Ethics are a part of every aspect of human existence. Some professions have excelled at developing an evolving code of ethics that is in tandem with the changing times, which they enforce and monitor religiously (Kumar, 2011). This research conformed to the ethical principles in scientific research as narrated in the social science research handbook (Bhattacharjee, 2012), and approved by the UCT Ethics Committee (Appendix D). The

researcher informed all respondents of their right to voluntary participation and all research data was held in strict confidentiality. The researcher also committed to publishing the final aggregated data and making recommendations for improving digital innovations in the sample community through the responsible ministry.

### 3.14 Chapter Summary

The objective of this study was to identify the factor affecting the development of digital innovations in Zimbabwe’s SMEs. In light of this goal, this chapter set a blueprint of how this explanatory research was conducted. A succinct illustration of these guidelines is given in Table 3 below.

<b>Title</b>	Investigating the factors affecting the development of digital innovations in Zimbabwe’s SMEs
<b>Purpose</b>	Explanatory
<b>Philosophy</b>	Positivist
<b>Approach to Theory</b>	Abduction
<b>Target Population</b>	SMEs in Zimbabwe
<b>Data Collection Method</b>	Questionnaire (Open and close-ended questions)
<b>Data Analysis</b>	Quantitative Methods <ul style="list-style-type: none"> <li>• Statistica + SPSS + MS Excel + SmartPLS</li> </ul> Qualitative Methods <ul style="list-style-type: none"> <li>• Thematic Analysis</li> </ul>
<b>Time Frame</b>	Cross Sectional

*Table 3 - Summary of Research Design and Methodology*

## 4. Data Analysis and Findings

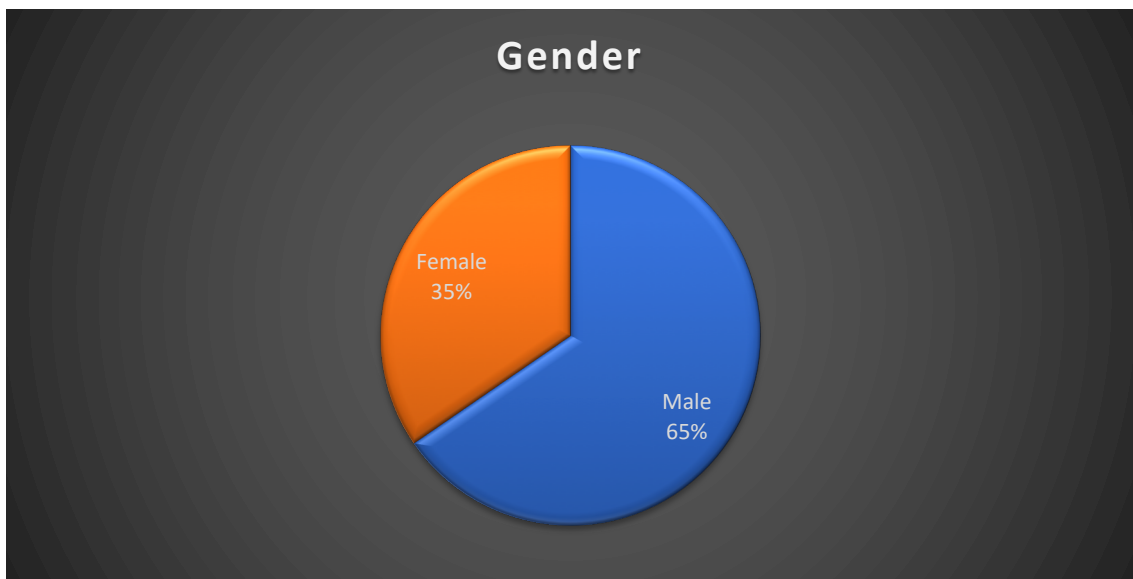
### 4.1 Introduction

This section will discuss the results and insights from both quantitative and qualitative data collected for the study. The chapter focuses on the different statistical tests carried out to validate the data and the research instrument, and some descriptive statistics on the data. The questionnaire collected data in four parts. Part A which focuses on the demographic data, part B for measuring the digital innovation capability of SMEs in Zimbabwe, part C for measuring the digital innovation performance of SMEs in Zimbabwe, and part D for capturing stakeholders' qualitative recommendations and contributions based on a set of open-ended questions. A total of 177 anonymous responses were received and 162 complete questionnaires were retained after data cleansing. Statistica 13, SPSS Statistics, SmartPLS and MS Excel were primarily used for this analysis.

### 4.2 Demographic Data

The questionnaire collected demographic data from the respondents relating to their age, gender, position, age of business, number of employees, industry and educational qualifications.

#### 4.2.1 Gender



*Figure 3 – Participants' Gender*

Figure 3 shows that two thirds of the participants were male while females accounted for 35% of the respondents. This statistic can be possibly attributed to a social imbalance in the country which gives males better access to ownership of resources and decision-making authority (Mazonde & Carmichael, 2016).

#### 4.2.2 Position

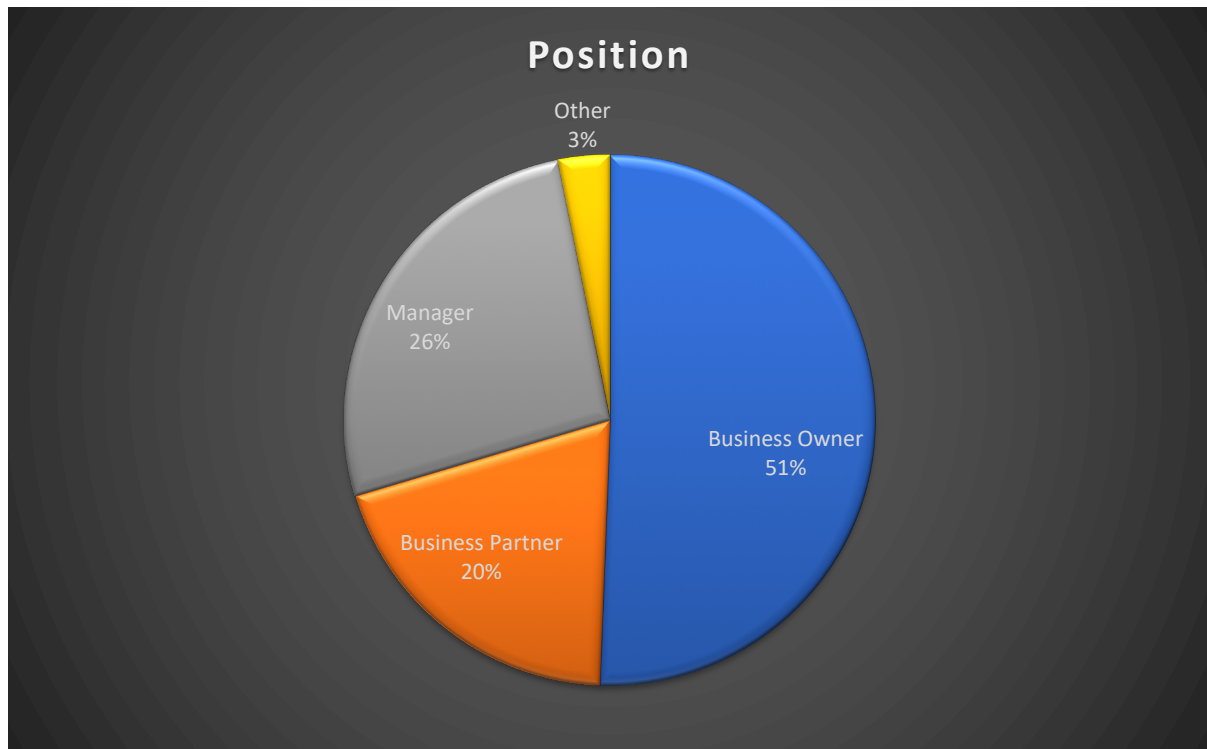


Figure 4 – Participants' Positions

The questionnaire mainly targeted participants that understand the business especially with regards to decision-making and strategy. Figure 4 above highlights these positions. A large proportion of the participants were business owners (51%), followed by managers (26%) and business partners (20%). Only 3% of the sample belonged to other categories such as ordinary employees of a firm. This confirms that the respondents were indeed decision makers in their respective firms.

#### 4.2.3 Age

There is a variety of literature that ties age to innovativeness in businesses (Table 2). The questionnaire made enquiry into the age groups of the participants as described in Figure 5. The results indicate that a sizeable number of participants fall within the range of 31-40 years (44%). This is an active age range in which graduates venture into their own businesses after

failing to secure formal employment or because of dissatisfaction at the workplace. Only 1% of the participants were below 21 years.

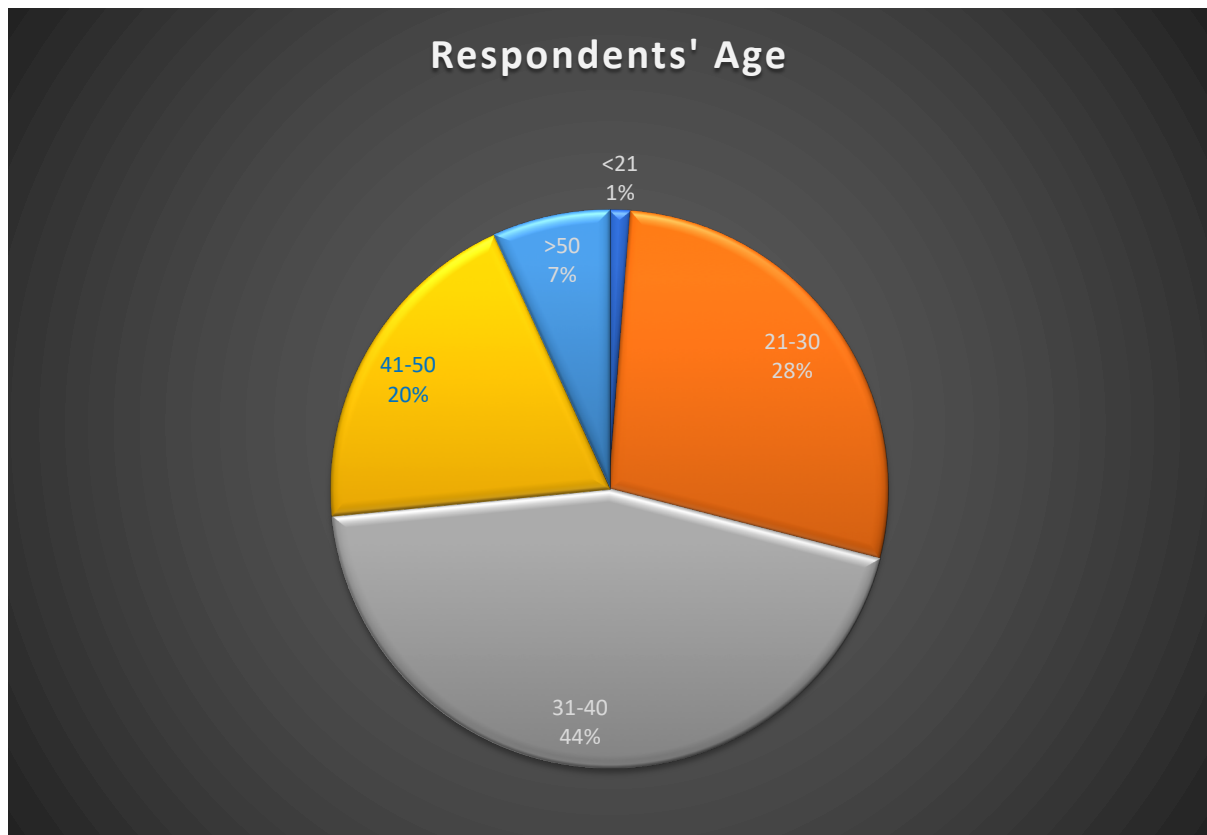


Figure 5 – Participants' Age

#### 4.2.4 Industry

The results show that the research achieved a variety of responses spread across various industries. The largest percentage of the participating SMEs are operating in retail (30%), while a significant portion is in manufacturing, IT services, consultancy and agriculture (combined 54%). Agriculture is a key industry in Zimbabwe's economy (FAO, 2020). The other participants are spread across logistics, marketing, music and arts, mining, catering, financial services and legal services (combined 16%).

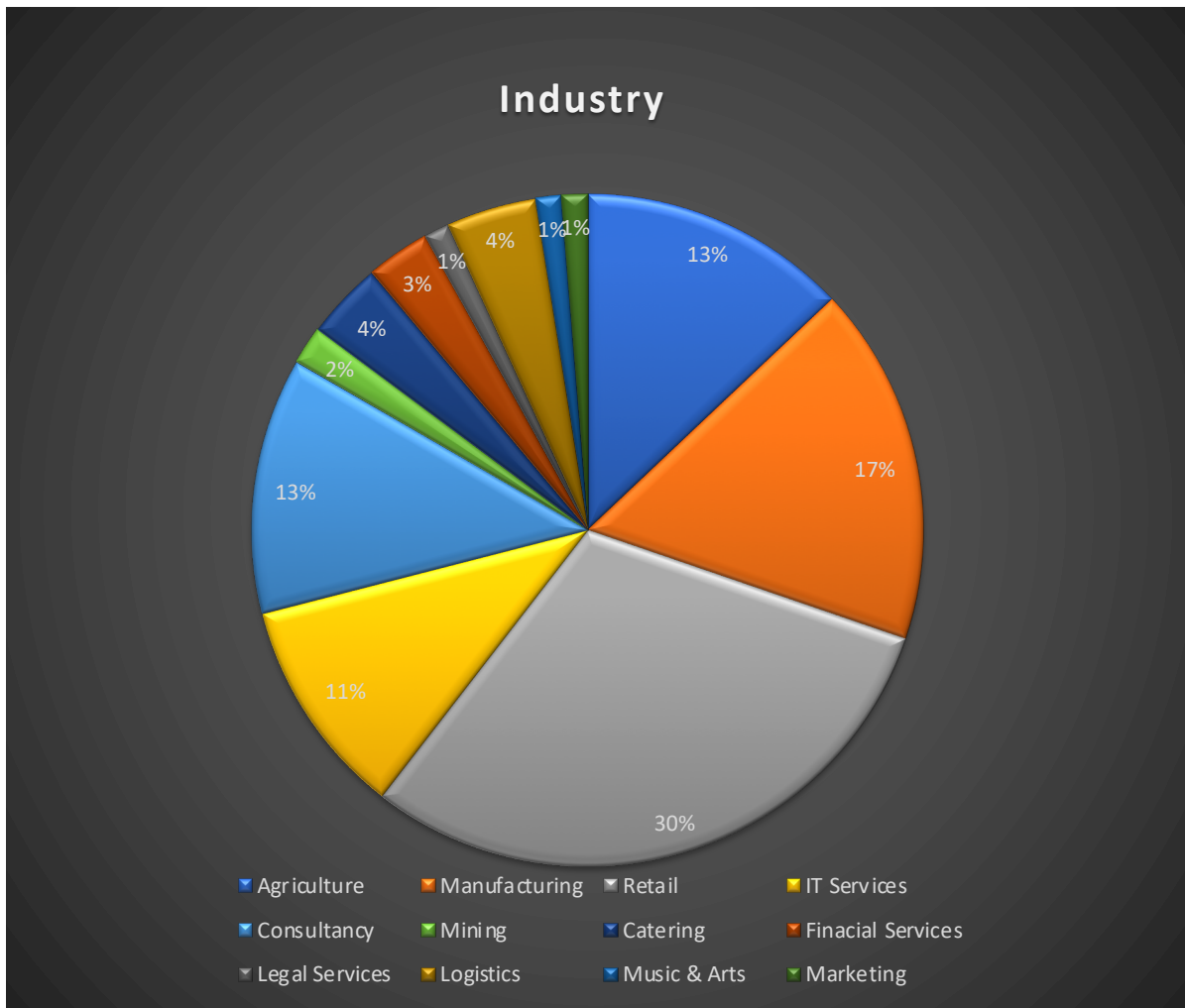


Figure 6 – Participants’ Industry

#### 4.2.5 Age of Business

Figure 7 illustrates the ages of the participating SMEs and the results indicate that around 47% of the participating SMEs are between 3 to 5 years. A combined 79% of the businesses fall in categories above 3 years. This is a positive indicator for Zimbabwe’s informal sector as most SMEs are said to fail within the first 3 years (Mudavanhu et al., 2011).

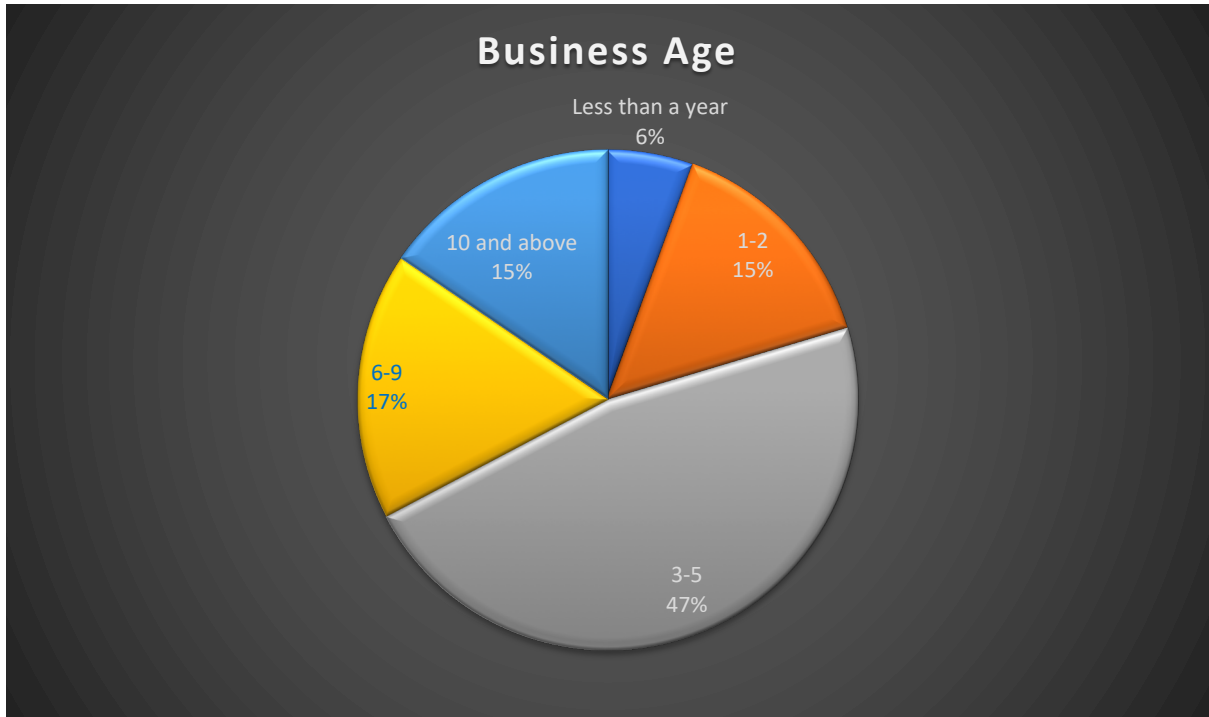


Figure 7 – Age of Participants' Businesses

#### 4.2.6 Number of Employees

As indicated in the literature, in some instances SMEs are qualified on the basis of the number of employees working in the firm (Nyoni & Bonga, 2018). Figure 8 shows the composition of employees in the different participating SMEs. The results indicate that around 70% of the firms have no more than 10 employees, and a combined 94% have no more than 50 employees. On the basis of size, all the participating firms qualify as SMEs.

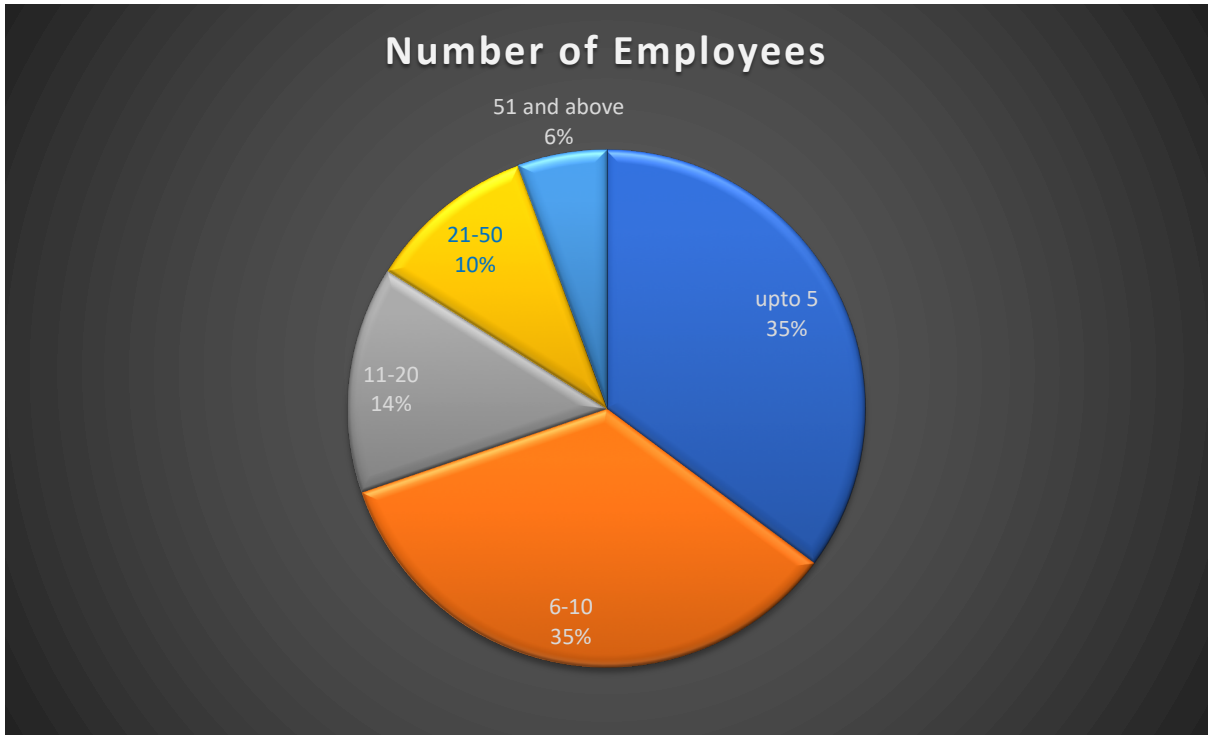


Figure 8 – Businesses' Number of Employees

#### 4.2.7 Educational Qualifications

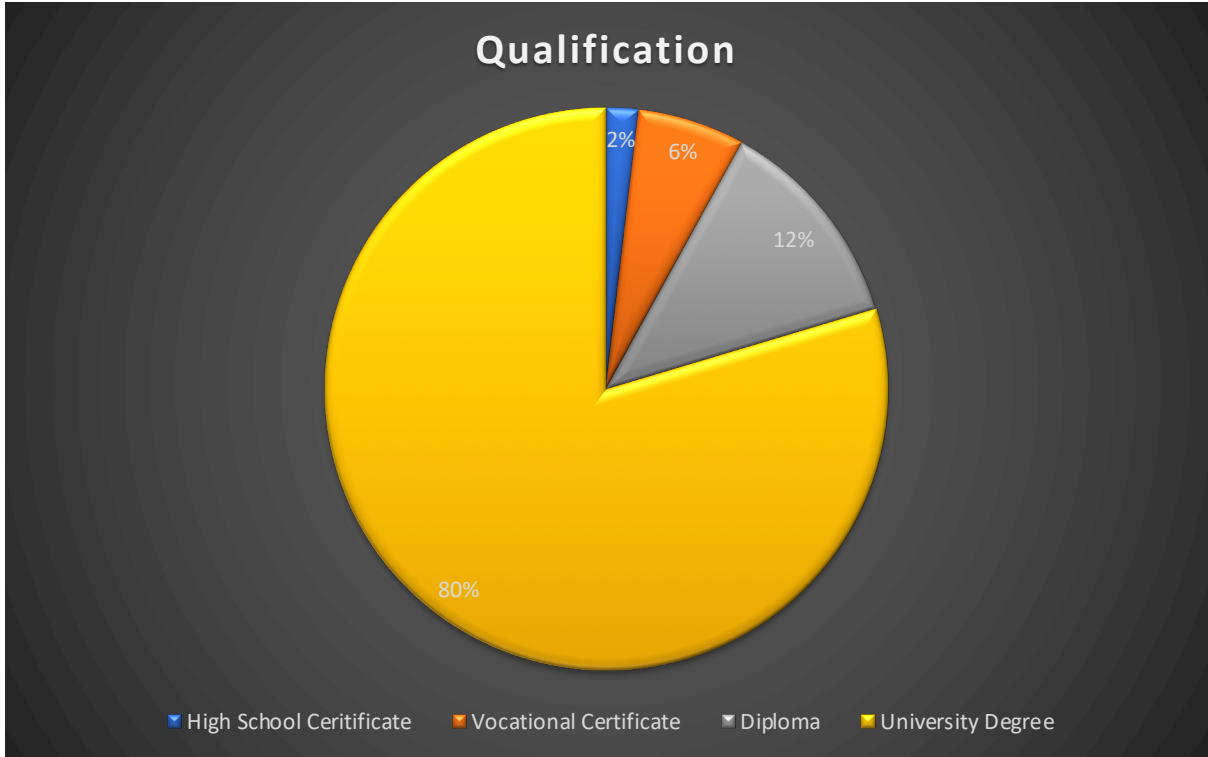


Figure 9 – Participants' Educational Qualifications

Figure 9 illustrates the educational qualifications of the participants. 80% of the respondents hold a university degree, and a combined 98% hold a qualification higher than a high school certificate. The statistics corroborate the literature which pegs Zimbabwe as having a high educated population and literacy rate (UNESCO, 2014). Additionally, more than 75% of the total workforce is employed in the informal sector as serious graduate unemployment continues to dog the economy (Mafumbate, Gondo, & Mutekwe, 2014).

### 4.3 Measuring Digital Innovation Capability/Capacity

#### 4.3.1 Innovation Capability

The research investigated the digital innovation capability (ICP) of a firm which can be loosely classified as either high or low. This dependent variable was measured across the 5 types of innovation products (ICPs) shown in Table 4 (Makanyeza & Dzvuke, 2015), which were rated using a 5-point Likert scale (1 – None, 2 – Low, 3 – Moderate, 4 – High and 5 – Very High). The results of the analysis are shown in the sections below and generally indicate that SMEs in Zimbabwe have a **low innovation capability**.

Code	Product	Description
ICP1	Process Innovation	New or significantly improved methods of manufacturing or producing goods or services
ICP2	Process Innovation	New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing
ICP3	Marketing Innovation	New or significantly improved marketing or distribution methods for your inputs, goods or services
ICP4	Product Innovation	New or significantly improved goods
ICP5	Service Innovation	New or significantly improved services
ICP6	Service Innovation	New business practices using digital technologies
ICP7	Organisational Innovation	New methods of organizing work responsibilities and decision making
ICP8	Organisational Innovation	New methods for organizing external relations with other firms, institutions, suppliers or customers

Table 4 - Innovation Capability Products (ICP)

### 4.3.2 Descriptive Analysis

Figure 10 below shows that an average 70% of the respondents indicated their firms have either None or Low innovation capability in process, product and organisational innovations. There is potential for market and service innovations, with a moderate rating for both products in 43% of the firms. A significant minority of the respondents had a “very high” rating across Market Innovations, Product Innovations and Service Innovations. These firms represent 7% of the sample and belong to the IT Services, Financial Services, and Retail sectors. This outcome is not coincidental as these industries have already been shown to utilise digital technologies more than others (Gandhi, Khanna, & Ramaswamy, 2016).

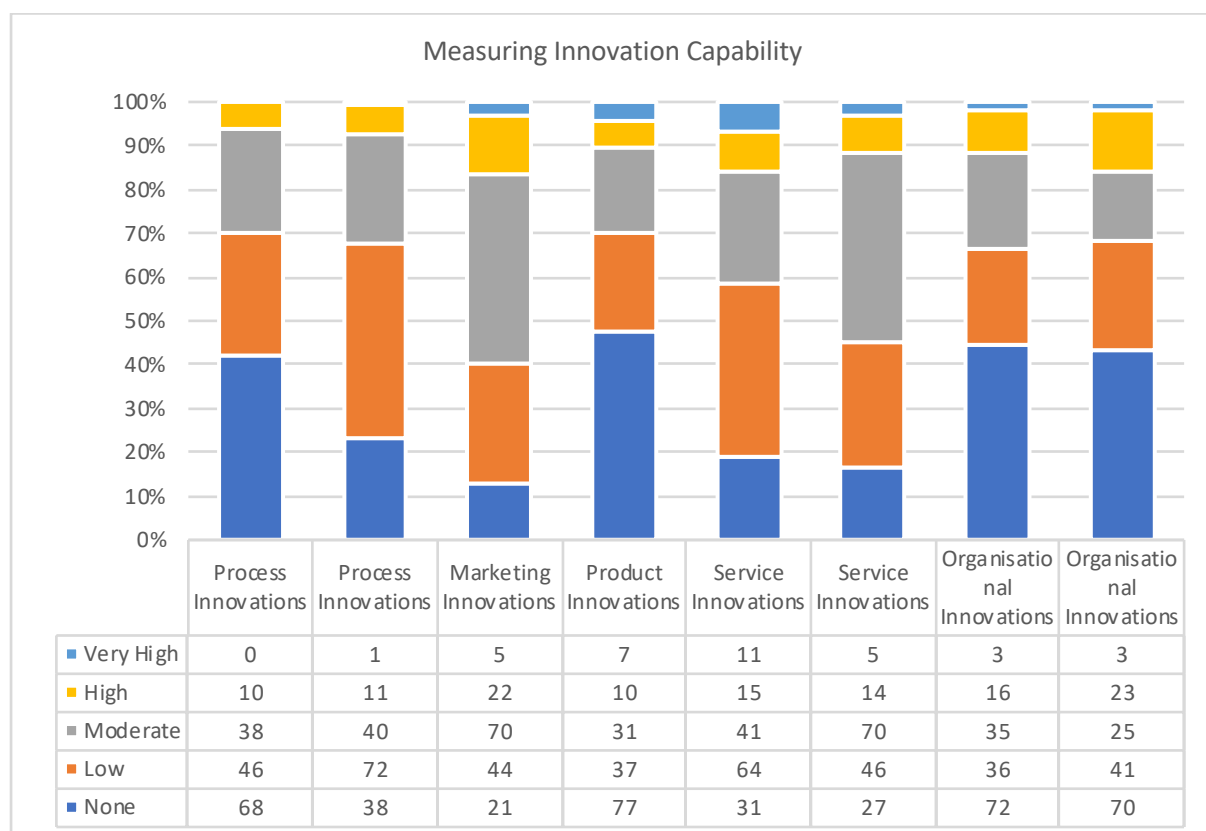


Figure 10 - Innovation Capability Products Stacked Graph

### 4.3.3 Innovation Capability Factors

The questionnaire investigated 26 test items that affect a firm’s innovation capability as shown in Table 5. The respondents were asked to rate the impact of each of the test items on their firm using a 5-point Likert scale ranging between 1 and 5 (1 – None, 2 – Low, 3 – Medium, 4 – High and 5 – Very High). The test items are given in Table 5 and the full distribution analysis is attached in Appendix F.

<b>Test Item</b>	<b>Code</b>	<b>Test Item</b>	<b>Code</b>
Size of firm	ICF1	Lack of suitably qualified personnel	ICF14
Age of firm	ICF2	Lack of information on digital innovation	ICF15
Business sector/industry	ICF3	Lack of information on market trends	ICF16
Employee average age	ICF4	Lack of proper knowledge management framework	ICF17
Organisation culture and beliefs	ICF5	Lack of research and development strategy	ICF18
No rewarding system for digital innovations	ICF6	Lack of knowledge on competitor behaviour	ICF19
Employee's ability to work together	ICF7	Ability to acquire new knowledge	ICF20
Organisation hierarchy/structure	ICF8	Level of education of employees	ICF21
Organisation risk attitude	ICF9	Relevance of national curriculum	ICF22
Management strategy in business operations	ICF10	Employee's digital skills	ICF23
Frequency of change in management	ICF11	Need to leverage digital innovations for competitive advantage	ICF24
Management awareness and support	ICF12	Other alternatives for competitive advantage	ICF25
Management digital competencies	ICF13	Pressure from competitors	ICF26

*Table 5 - Innovation Capacity Test Items*

#### 4.3.4 Most Important Factor

Respondents were asked to select three test items that they rated as most critical to their firm's innovation capability using a 3-point Likert scale (1 – Extremely Important, 2 – Highly – Important and 3 - Important). The results summarised in Table 6 indicate that 54% of the participants believe their firm's innovation capability is affected by the business sector/industry they are operating in.

	<b>Valid N</b>	<b>Test Item Code</b>	<b>Test Item</b>	<b>Count (n)</b>	<b>Percentage (%)</b>
Extremely Important	162	ICF3	Business sector/industry	88	54,32

Highly Important	162	ICF23	Employee's digital skills	72	44,44
Important	162	ICF15	Lack of information on digital innovation	56	34,57

Table 6 – Most Important Innovation Capability Factors

#### 4.3.5 Construct Reliability Tests (Initial Model)

A Cronbach Alpha test was performed on the test items in order to evaluate the inter-item reliability (Field, 2009). For each construct, the correlations between the respective item and the total sum score and the internal consistency of the scale (alpha) were examined. The results of the tests are summarised in Table 7 below.

Construct	Valid N	Number of Items	Cronbach Alpha	Inter-item corr.	Implied Reliability
Firm Demographics	162	4	0,60	0,34	Acceptable
Culture	162	5	0,84	0,53	Very Good
Organisational Management	162	4	0,75	0,45	Respectable
Knowledge Management	162	7	0,85	0,48	Very Good
Education	162	3	0,72	0,48	Respectable
Competitive Advantage	162	3	0,89	0,73	Very Good

Table 7 – ICF Construct Reliability Tests (Initial Model)

The implied reliability from the Cronbach Alpha scores were evaluated according to the DeVellis Scale which proposes the following criteria: below .60 – unacceptable, between .60 and .65 – undesirable, between .65 and .70 – minimally acceptable, between .70 and .80 – respectable, between .80 and .90 – very good, much above .90 – consider shortening the scale. Half of the constructs retained a score which is either “Very Good” or “Respectable”. The least scoring construct managed a Cronbach Alpha of 0.6 but was retained as part of the instrument as this is an acceptable score for exploratory purposes (Ngai, Cheng, & Ho, 2004). It is evident that, based on the reliability tests, the research instrument was reliable.

### 4.3.6 Construct Validity

Construct validity was used to measure whether the scale used measures the construct adequately and also measures the strengths of relationships between items in a given construct. A factor analysis test was carried out several times on the test items using a Varimax Normalised Rotation and variations of Eigenvalues (Field, 2009). The final acceptable factor loadings were set at 0.5, and a minimum eigenvalue of 0.8 (Appendix G) based on the Kaiser-Meyer-Olkin criterion (Hadi, Abdullah, & Ilham, 2016). The test established six factors which accounted for 73.79% of the variance in the data as summarised in Table 8 below. Generally, the tests indicate that both the research instrument and data are valid. There is also an indication that the respondents understood the research questions clearly.

Factor	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	10,83	41,65	10,83	41,65
2	3,58	13,77	14,41	55,43
3	1,79	6,88	16,20	62,31
4	1,16	4,45	17,36	66,76
5	1,03	3,95	18,38	70,70
6	0,80	3,08	19,18	73,79

Table 8 - ICF Eigen Values

Factor	Construct Label	Interpretation
1	CMI	Items ICF16 – ICF14 load on to one factor representing “Competition and Market Information”
2	IND	Items ICF3, ICF14 & ICF23 load on to one factor representing “Industry”
3	OM	Items ICF9 – ICF13 load on to one factor representing “Organisational Management”
4	FD	Items ICF1 & ICF2 load on to one factor representing “Firm Demographics”
5a	SF	Items ICF7 & ICF20 – ICF22 load on to one factor representing “Skills Factor”
5b	CA	Items ICF24 – ICF 26 load on to one factor representing “Competitive Advantage”
6	CLR	Items ICF4 – ICF6 & ICF8 load on to one factor representing “Culture”

Table 9 – Summary of ICF Factor Loadings

#### 4.3.7 Construct Reliability Tests (Revised Model)

The Cronbach Alpha tests were re-run on the revised model as given in Table 10 below. All the constructs managed a score above 0.8 therefore indicating high inter-item reliability.

<b>Construct</b>	<b>Valid N</b>	<b>Number of Items</b>	<b>Cronbach Alpha</b>	<b>Inter-item corr.</b>	<b>Implied Reliability</b>
Competition and Market Information	162	4	0,91	0,71	Very Good
Industry	162	3	0,79	0,56	Very Good
Organisational Management	162	4	0,86	0,61	Very Good
Firm Demographics	162	2	0,89	0,81	Very Good
Skills Factor	162	4	0,83	0,56	Very Good
Competitive Advantage	162	3	0,89	0,73	Very Good
Culture	162	4	0,82	0,54	Very Good

*Table 10 - Construct Reliability Tests (Revised Model)*

#### 4.3.8 Correlations Matrix

A correlations table was created to test the strength of existing relationships between the various test items (Appendix H). Many of the test items showed moderate correlations between them, with their correlation coefficient ranging between 0.4 and 0.7, and no signs of multicollinearity. Additionally, a Spearman rank-order correlations table was created to examine the correlations between the model variables. The full results of the test are given in Appendix I and summarised in Table 11. The results show highly significant correlations between digital innovation capability and all the independent constructs at  $p < 0.05$ , except Industry and Organisational Management. A number of constructs showed moderate (0.4-0.7) and strong ( $>0.7$ ) correlations between them as follows:

- Firm Demographics showed a moderate correlation with Innovation Capability, Skills Factor and Competitive Advantage
- Culture showed a moderate correlation with Competition and Market Information, Skills Factor and Competitive Advantage
- Organisational Management showed a moderate correlation with Industry
- Competition and Market Information showed a moderate correlation with Skills Factor
- Competitive Advantage showed a strong correlation with Competition and Market Information and Skills Factor

Pair of Variables	Spearman Rank Order Correlations MD pairwise deleted Marked correlations are significant at $p < ,0500$			
	Valid (N)	Spearman (R)	t(N-2)	p-value
Innovation Capability & Competition and Market Information	162	0,32	4,24	0,00
Innovation Capability & Industry	162	-0,03	-0,36	0,72
Innovation Capability & Organisational Management	162	0,13	1,61	0,11
Innovation Capability & Firm Demographics	162	0,53	7,83	0,00
Innovation Capability & Skills Factor	162	0,36	4,94	0,00
Innovation Capability & Competitive Advantage	162	0,39	5,30	0,00
Innovation Capability & Culture	162	0,42	5,91	0,00

Table 11 – Selected Spearman Rank Order Correlations

#### 4.3.9 Regression Analysis

Regression analysis is a way of predicting the outcome of a variable from a predictor variable (simple regression) or several predictor variables (multiple regression) (Field, 2009). To test the effects of the independent variables on the dependent variable, both simple and multiple regression analysis with the six independent variables was conducted.

##### i. Simple Regression Analysis

The results of the analysis are summarised in Table 12. Three variables, namely Firm Demographics, Culture and Competitive Advantage show moderate positive correlation with innovation capability. These variables respectively account for 27%, 19% and 16% of original variance and are highly significant at  $p < 0,001$ . The other significant variables at  $p < 0,001$  are Skills Factor and Competition and Market Information.

Variable	b*	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error of the Estimate	p-value
Competition & Market Info	0,33	0,11	0,11	0,82	0,00
Industry	-0,02	0,00	–	0,87	0,77
Organisational Management	0,11	0,01	0,01	0,86	0,14
Firm Demographics	0,51	0,27	0,26	0,75	0,00
Skills Factor	0,38	0,15	0,14	0,80	0,00
Competitive Advantage	0,40	0,16	0,15	0,80	0,00
Culture	0,44	0,19	0,19	0,78	0,00

Table 12 - Simple Regression Analysis Summary

ii. Multiple Regression Analysis

Multiple regression analysis was used to test the simultaneous effects of the independent variables on innovation capability. The results presented in Table 13 explain 32.59% of the original variance and show a moderate correlation ( $R = 0,57$ ). The tests retained only Firm Demographics and Culture as statistically significant variables at  $p < 0,05$ . Both variables have a positive relationship with innovation capability. The other significant variables from the simple regression analysis disappear due to a weaker correlation with the dependent variable.

N=162	Regression Summary for Dependent Variable: Innovation Capability R= ,5708 R <sup>2</sup> = ,3259 Adjusted R <sup>2</sup> = ,2952 F(7,154)=10,634 p<,0000 Std.Error of estimate: ,7293					
	b*	Std.Err. (of b*)	b	Std.Err. (of b)	t(154)	p-value
Intercept			0,91	0,31	2,93	0,00
Competition & Market Information	0,02	0,11	0,02	0,10	0,23	0,82
Industry	-0,16	0,09	-0,15	0,08	-1,83	0,07
Organisational Management	0,06	0,10	0,06	0,10	0,62	0,53
Firm Demographics	0,36	0,09	0,33	0,08	3,97	0,00
Skills Factor	0,02	0,13	0,02	0,14	0,16	0,87
Competitive Advantage	0,05	0,13	0,05	0,13	0,36	0,72
Culture	0,22	0,10	0,24	0,11	2,14	0,03

Table 13 - Multiple Regression Analysis

## 4.4 Measuring Digital Innovation Performance

### 4.4.1 Innovation Performance

The research investigated the digital innovation performance (IPP) of a firm which can be loosely classified as either high or low. This dependent variable was measured across the 5 types of innovation products (IPPs) as shown in Table 14 (Makanyeza & Dzvuke, 2015), which were rated using a 5-point Likert scale (1 – Never, 2 – Seldom, 3 – Sometimes, 4 – Often and 5 – Very Often). The results of the analysis are shown in the sections below and generally indicate that SMEs in Zimbabwe have a **low innovation performance**.

Code	Product	Description
IPP1	Process Innovation	New or significantly improved methods of manufacturing or producing goods or services
IPP2	Process Innovation	New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing
IPP3	Marketing Innovation	New or significantly improved marketing or distribution methods for your inputs, goods or services
IPP4	Product Innovation	New or significantly improved goods
IPP5	Service Innovation	New or significantly improved services
IPP6	Service Innovation	New business practices using digital technologies
IPP7	Organisational Innovation	New methods of organizing work responsibilities and decision making
IPP8	Organisational Innovation	New methods for organizing external relations with other firms, institutions, suppliers or customers

*Table 14 - Innovation Performance Products (IPP)*

### 4.4.2 Descriptive Analysis

Figure 11 shows that the majority of the respondents indicated their firms “never” or “seldom” deploy 88% of the innovation products used to measure innovation performance. Only 39% of the firms show propensity to introduce service innovations “sometimes”. The same significant minority previously established to have very high innovation capability also displayed very high innovation performance.

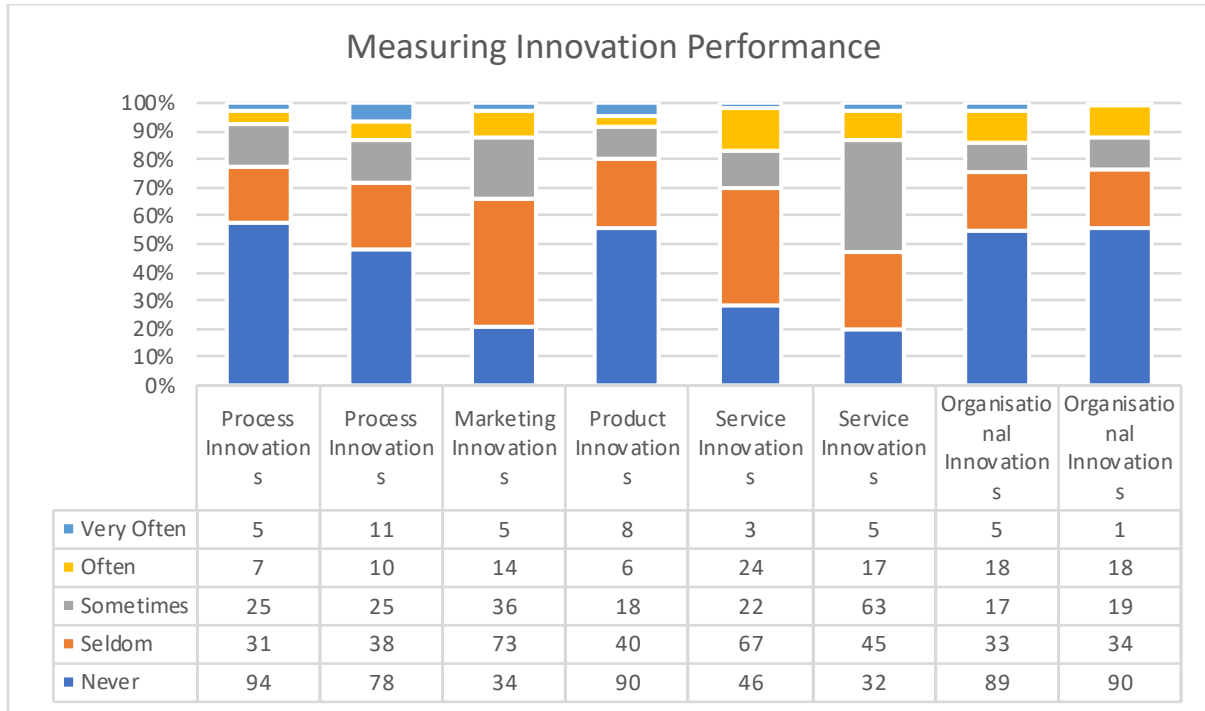


Figure 11 - Innovation Performance Products Stacked Graph

#### 4.4.3 Innovation Capability vs Innovation Performance

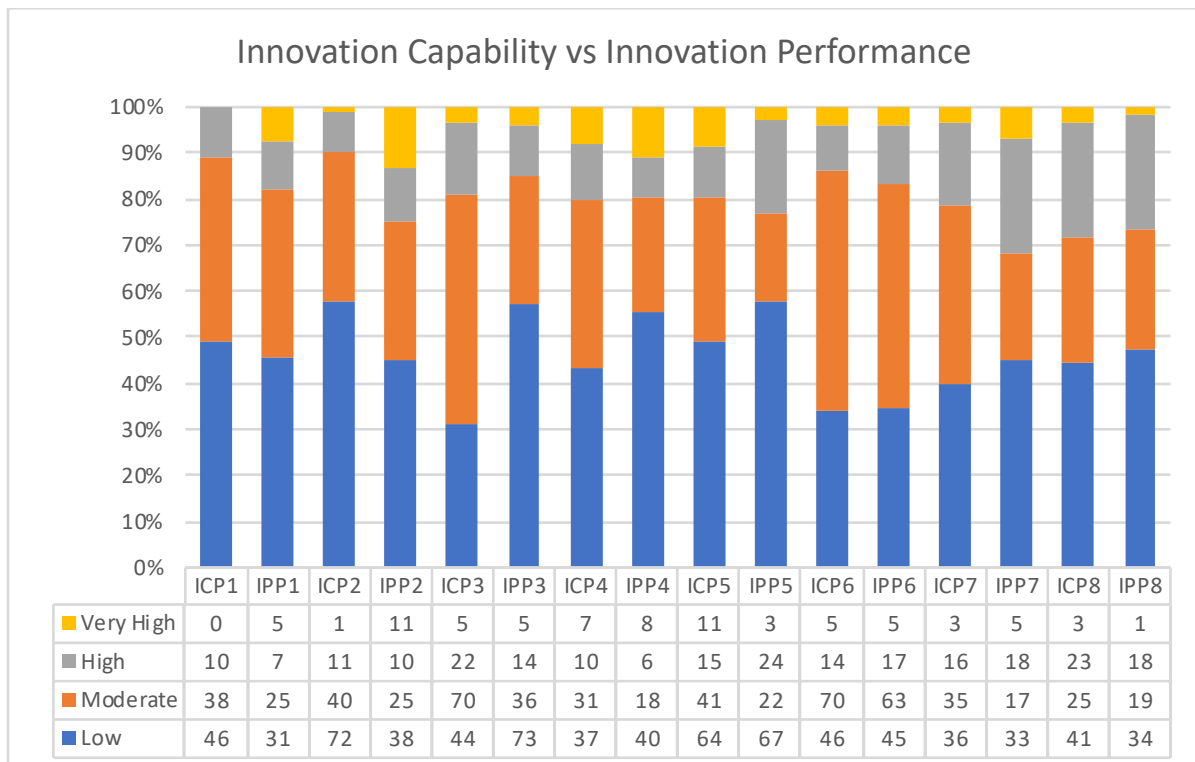


Figure 12 - Capability vs Performance Comparison

Figure 12 is a comparison of innovation capability (ICP) and innovation performance (IPP) across the five proxies used to capture innovation capability and performance (Janaratne, 2014). The results show that innovation performance is inherent to innovation capability and this relationship is supported in Table 29 and validated in the SEM Model (Figure 14). As previously established in the literature, increased innovation capability does not directly translate to increased innovation performance, thus explaining the numerical disparity between the indicators for Process, Market, Product and Service Innovations. There are several moderators affecting a firm’s ability to convert capability into actual innovation performance and these are investigated in the sections below. Generally, the low innovation capability results in low innovation performance as seen in Figure 12. In a model setting, innovation capability is expected to be more than or equal to the innovation performance except in cases where businesses perform beyond their capability as a result of external reinforcements or enablers as is the case with Market and Product Innovations.

#### 4.4.4 Innovation Performance Factors

Guided by the constructs of the conceptual model, the questionnaire investigated 28 test items that affect a firm’s ability to convert innovation capability into actual innovation performance (Table 15). The respondents were asked to rate the impact of each of the test items on their firm using a 5-point Likert scale ranging between 1 and 5 (1 – None, 2 – Low, 3 – Medium, 4 – High and 5 – Very High).

<b>Test Item</b>	<b>Code</b>	<b>Test Item</b>	<b>Code</b>
Lack of funds within your organisation	IPF1	Dynamic nature of digital technologies	IPF15
Lack of finance from external sources	IPF2	Level IT skills/expertise	IPF16
Costs of digital innovations	IPF3	Uncertain demand for digital good/services	IPF17
Availability of digital innovation platform	IPF4	Consumer expectations are too high	IPF18
Availability of digital innovation hubs	IPF5	Consumers prefer imported digital goods/services	IPF19
Protection of intellectual property rights	IPF6	Consumers prefer traditional goods/ services	IPF20
Government policy and politics	IPF7	Market dominated by established enterprises/imports	IPF21
Existence of supporting legal framework	IPF8	Market demand to justify the investment	IPF22
Availability of government incentives and support	IPF9	Availability of suitable market strategy	IPF23

Management strategy in business operations	IPF10	Availability of similar goods/services	IPF24
Frequency of change in management	IPF11	Opportunities for collaboration with other firms and suppliers of equipment, materials and components	IPF25
Management awareness and support	IPF12	Opportunities for interaction with universities and research institutions	IPF26
Management digital competencies	IPF13	Availability of professional and industry associations	IPF27
Availability of able technology infrastructure	IPF14	Opportunities for interaction with customers or clients	IPF28

*Table 15 - Innovation Performance Test Items*

#### 4.4.5 Most Important Factor

Respondents were asked to select three test items that they rated as most critical to their firm's innovation performance using a 3-point Likert scale (1 – Extremely Important, 2 – Highly – Important and 3 - Important). The results summarised in Table 16 below indicate that most participants believe their firm's innovation performance is affected by their organisation's level of IT skills/expertise. All these factors were touted in the literature as having a tremendous effect on the digital innovation performance of an enterprise (Chapter 2 - Table 2).

	Valid N	Test Item Code	Test Item	Count	Percentage (%)
Extremely Important	162	IPF16	Level of IT skills/expertise	50	30,86
Highly Important	162	IPF1	Lack of funds within your organisation	39	24,07
Important	162	IPF14	Availability of able technology infrastructure	29	17,90

*Table 16 - Most Important Innovation Performance Factors*

#### 4.4.6 Construct Reliability Tests (Initial Model)

A Cronbach Alpha test was performed on the test items in order to evaluate the inter-item reliability (Field, 2009). For each construct, the correlations between the respective item and the total sum score and the internal consistency of the scale (alpha) were examined. The results of the tests are summarised in Table 17.

<b>Construct</b>	<b>Valid N</b>	<b>Number of Items</b>	<b>Cronbach Alpha</b>	<b>Inter-item corr.</b>	<b>Implied Reliability</b>
Financial Resources	162	3	0,79	0,60	Respectable
Environment	162	6	0,83	0,50	Very Good
Organisational Management	162	4	0,73	0,45	Respectable
Technology	162	3	0,68	0,43	Minimally Acceptable
Consumer Demands	162	4	0,88	0,66	Very Good
Market	162	4	0,91	0,73	Very Good
Networking & Collaboration	162	4	0,92	0,75	Very Good

*Table 17 - IPF Construct Reliability Tests (Initial Model)*

The implied reliability from the Cronbach Alpha scores were evaluated according to the DeVellis Scale which proposes the following criteria: below .06 – unacceptable, between .60 and .65 – undesirable, between .65 and .70 – minimally acceptable, between .70 and .80 – respectable, between .80 and .90 – very good, much above .90 – consider shortening the scale. Half of the constructs retained a score which is either “Very Good” or “Respectable”. The least scoring construct managed a Cronbach Alpha of 0.68 but was retained as part of the instrument as this is an acceptable score for exploratory purposes (Ngai et al., 2004). Generally, the reliability tests indicate that the research instrument was reliable.

#### 4.4.7 Construct Validity

Construct validity was used to measure whether the scale used measures the construct adequately and also measures the strengths of relationships between items in a given construct. A factor analysis test was carried out several times on the test items using a Varimax Normalised Rotation and variations of Eigenvalues (Field, 2009). The final acceptable factor loadings were set at 0.5, and a minimum eigenvalue of 0.8 (Appendix K) based on the Kaiser-Meyer-Olkin criterion (Hadi et al., 2016). The test established six factors which accounted for 78.61% of the variance in the data as summarised in Table 18. Generally, the tests indicate that both the research instrument and data are valid. There is also an indication that the respondents understood the research questions clearly.

<b>Factor</b>	<b>Eigenvalue</b>	<b>% Total variance</b>	<b>Cumulative Eigenvalue</b>	<b>Cumulative %</b>
1	13,70	48,93	13,70	48,93
2	3,39	12,11	17,09	61,03
3	1,57	5,60	18,66	66,64
4	1,34	4,77	19,99	71,41
5	1,02	3,64	21,01	75,05
6	1,00	3,56	22,01	78,61

*Table 18 - IPF Eigen Values*

<b>Factor</b>	<b>Construct Label</b>	<b>Interpretation</b>
1	MEEC	Items IPF17 – IPF28 load on to one factor representing “Market Environment and External Collaboration”
2	OD	Items IPF10, IPF12 – IPF14 & IPF16 load on to one factor representing “Organisational Dynamics”
3	LE	Items IPF6, IPF6 & IPF15 load on to one factor representing “Legal Environment”
4	FR	Items IPF1 & IPF2 load on to one factor representing “Financial Resources”
5	PNA	Items IPF4 & IPF 5 load on to one factor representing “Platforms for Networking and Access to Digital Innovation”
6	GP	Items IPF7 & IPF9 load on to one factor representing “Government Policy”

*Table 19 - Summary of IPF Factor Loadings*

#### 4.4.8 Construct Reliability Tests (Revised Model)

The Cronbach Alpha tests were re-run to ascertain the inter-item reliability of the revised model (Field, 2009). The summary of the results is given in Table 20 below. All the constructs managed a score above 0.8 except Government Policy which had a 0.6.

<b>Construct</b>	<b>Valid N</b>	<b>Number of Items</b>	<b>Cronbach Alpha</b>	<b>Inter-item corr.</b>	<b>Implied Reliability</b>
Market Environment and External Collaboration	162	12	0.96	0,70	Very Good
Organisational Dynamics	162	5	0,88	0,61	Very Good
Legal Environment	162	3	0,88	0,71	Very Good

Financial Resources	162	2	0,91	0,83	Very Good
Platforms for Networking and Access to Digital Innovation	162	2	0,88	0,78	Very Good
Government Policy	162	2	0,60	0,42	Undesirable

Table 20 - Construct Reliability Tests (Revised Model)

#### 4.4.9 Correlations Matrix

A correlations table was created to test the strength of existing relationships between the various test items (Appendix M). Many of the test items showed moderate correlations between them, with their correlation coefficient ranging between 0.4-0.7, and no signs of multicollinearity. Additionally, a Spearman rank-order correlations table was created to examine the correlations between the model variables. The full results of the test are given in Appendix N and summarised in Table 21 below. The results show highly significant correlations between digital innovation performance and all the moderator constructs at  $p < 0.05$ , except Government Policy and Organisational Dynamics. A number of constructs showed moderate (0.4-0.7) and strong ( $>0.7$ ) correlations between them as follows:

- Platforms for Networking and Access to Digital Innovation showed moderate correlations with Legal Environment, Government Policy and Market Environment & External Collaboration
- Financial Resources showed moderate correlations with Government Policy and Organisational Dynamics
- Government Policy showed strong correlations with Organisational Dynamics
- Market Environment & External Collaboration showed strong correlations with Legal Environment

Pair of Variables	Spearman Rank Order Correlations MD pairwise deleted Marked correlations are significant at $p < ,0500$			
	Valid (N)	Spearman (R)	t(N-2)	p-value
Innovation Performance & Market Environment and External Collab.	162	0,31	4,16	0,00
Innovation Performance & Organisational Dynamics	162	0,07	0,93	0,35
Innovation Performance & Legal Environment	162	0,29	3,77	0,00

Innovation Performance & Financial Resources	162	0,20	2,57	0,01
Innovation Performance & Platforms for Networking and Access to Digital Innovation	162	0,28	3,74	0,00
Innovation Performance & Government Policy	162	0,07	0,93	0,35

Table 21 - Selected Spearman Rank Order Correlations

#### 4.4.10 Regression Analysis

##### i. Moderated Simple Regression Analysis

To establish the effect of the moderating variables from the conceptual model on the relationship between innovation capability (IC) and innovation performance (IP), moderated linear regression analysis with the 6 moderating variables was conducted. The test involves including the interaction effect in the model to check whether it is significant or not. This interaction effect is expressed as product of the independent variable (IC) and the respective moderator variable (Hayes, 2017).

##### a. Effect of Market Environment and External Collaboration

The direct effect ( $p=0,01$ ) and interaction effect ( $p=0,00$ ) were statistically significant at  $p<0,05$ , indicating that the Market Environment and External Collaboration (MEEC) is both a significant influencer and moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 22 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,84	0,70	0,25	124,27	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,85	0,30	2,86	0,00	0,26	1,44
IC	0,46	0,14	3,22	0,00	0,18	0,75
MEEC	-0,30	0,12	-2,55	0,01	-0,54	-0,07
IC x MEEC	0,15	0,05	2,93	0,00	0,05	0,26

Table 22 - Moderation Regression Analysis MEEC

b. Effect of Organisational Dynamics

The direct effect ( $p=0,16$ ) and interaction effect ( $p=0,42$ ) were not statistically significant at  $p<0,05$ , indicating that Organisational Dynamics (OD) is not a significant influencer or moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 23 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,83	0,69	0,26	119,26	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,78	0,49	1,57	0,11	-0,19	1,76
IC	0,72	0,20	3,65	0,00	0,33	1,10
OD	-0,19	0,13	-1,42	0,16	-0,45	0,07
IC x OD	0,04	0,05	0,80	0,42	-0,06	0,15

Table 23 - Moderation Regression Analysis OD

c. Effect of Legal Environment

The direct effect ( $p=0,03$ ) and interaction effect ( $p=0,01$ ) were statistically significant at  $p<0,05$ , indicating that the Legal Environment (LE) is both a significant influencer and moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 24 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,84	0,70	0,25	122,79	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,73	0,28	2,56	0,01	0,17	1,30
IC	0,56	0,12	4,48	0,00	0,31	0,80
LE	-0,25	0,11	-2,19	0,03	-0,47	-0,02
IC x LE	0,12	0,04	2,63	0,01	0,03	0,20

Table 24 - Moderation Regression Analysis LE

d. Effect of Financial Resources

The direct effect ( $p=0,56$ ) and interaction effect ( $p=0,68$ ) were not statistically significant at  $p<0,05$ , indicating that Financial Resources (FR) is not a significant influencer or moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 25 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,83	0,69	0,26	115,64	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,30	0,36	0,82	0,41	-0,42	1,02
IC	0,81	0,14	5,52	0,00	0,52	1,10
FR	-0,06	0,11	-0,58	0,56	-0,28	0,15
IC x FR	0,02	0,04	0,41	0,68	-0,07	0,10

Table 25 - Moderation Regression Analysis FR

e. Effect of Platform for Networking and Access to Digital Innovation

The direct effect ( $p=0,05$ ) and interaction effect ( $p=0,02$ ) were statistically significant at  $p<0,05$ , indicating that the Platform for Networking and Access to Digital Innovation (PNA) is both a significant influencer and moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 26 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,83	0,70	0,25	120,87	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,89	0,40	2,21	0,03	0,09	1,68
IC	0,50	0,16	3,03	0,00	0,17	0,82
PNA	-0,27	0,14	-1,94	0,05	-0,54	0,00
IC x PNA	0,12	0,05	2,29	0,02	0,02	0,23

Table 26 - Moderation Regression Analysis PNA

f. Effect of Government Policy

The direct effect ( $p=0,06$ ) and interaction effect ( $p=0,11$ ) were not statistically significant at  $p<0,05$ , indicating that Government Policy (GP) is not a significant influencer or moderator of the relationship between digital innovation capability and innovation performance. The results of the analysis are summarised in Table 27 below.

<b>Outcome Variable: Innovation Performance (N = 162)</b>						
<b>R</b>	<b>R<sup>2</sup></b>	<b>MSE</b>	<b>F</b>	<b>df1</b>	<b>df2</b>	<b>p</b>
0,83	0,68	0,26	118,99	3,00	158,00	0,00
<b>Model</b>						
	<b>coeff</b>	<b>se</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
constant	0,78	0,38	2,05	0,04	0,03	1,53
IC	0,62	0,16	3,83	0,00	0,30	0,95
GP	-0,21	0,11	-1,88	0,06	-0,43	0,01
IC x GP	0,07	0,05	1,59	0,11	-0,02	0,17

Table 27 - Moderation Regression Analysis GP

ii. Multiple Regression Analysis

Multiple regression analysis was used to test the simultaneous direct effects of the independent variables on innovation performance. The results presented in table below explain 18.35% of the original variance and show a moderate correlation ( $R = 0,41$ ). The tests retained only Organisational Dynamics as a statistically significant variable at  $p<0,05$ .

<b>N=162</b>	<b>Regression Summary for Dependent Variable: Innovation Performance</b>					
	<b>R= ,4284 R<sup>2</sup>= ,1835 Adjusted R<sup>2</sup>= ,1519 F(6,155)=5,8055 p&lt;,00002 Std.Error of estimate: ,8347</b>					
	<b>b*</b>	<b>Std.Err. (of b*)</b>	<b>b</b>	<b>Std.Err. (of b)</b>	<b>t(155)</b>	<b>p-value</b>
Intercept			1,46	0,36	4,08	0,00
Financial Resources	0,12	0,09	0,12	0,08	1,40	0,16
Platform for Networking and Access to Digital Innovation	0,18	0,11	0,22	0,13	1,67	0,10
Legal Environment	0,13	0,12	0,13	0,12	1,07	0,29

Government Policy	-0,09	0,10	-0,09	0,10	-0,94	0,35
Organisational Dynamics	-0,25	0,09	-0,28	0,11	-2,62	0,01
Marketing Environment and External Collab.	0,20	0,12	0,23	0,13	1,75	0,08

*Table 28 - Multiple Regression Analysis*

#### 4.4.11 Innovation Performance Rankings

The respondents were asked to rank the innovation performance of SMEs based on a geographical context using a 5-point Likert scale (1 – None, 2 – Low, 3 – Medium, 4 – High and 5 – Very High). At least 60% of the participants perceived innovation performance in Zimbabwe (ZW), Southern Africa (SADC), and Africa (AU) to be “low” compared to global SMEs which retained a “high” rating (Figure 13). This is a perturbing outcome which can be unpacked at several levels. Fundamentally, the adoption of ICT involves some measure of substantive learning and investment which is difficult to achieve under the current economic climate as explained in Section 2.2. The continent’s ICT landscape is largely donor-driven and poorly adapted (Ziaie, 2013). Low digital innovation performance is therefore a consequence of dependency and underutilisation of ICT resources reinforced by inappropriate curriculums, poor knowledge management, a general lack of awareness, and by subscription inappropriate technology tools. In essence, SMEs have not been fully active in developing indigenous knowledge and innovative capacity in Africa (UNCTAD, 2018). Other key observations and recommendations are discussed in Section 4.8.

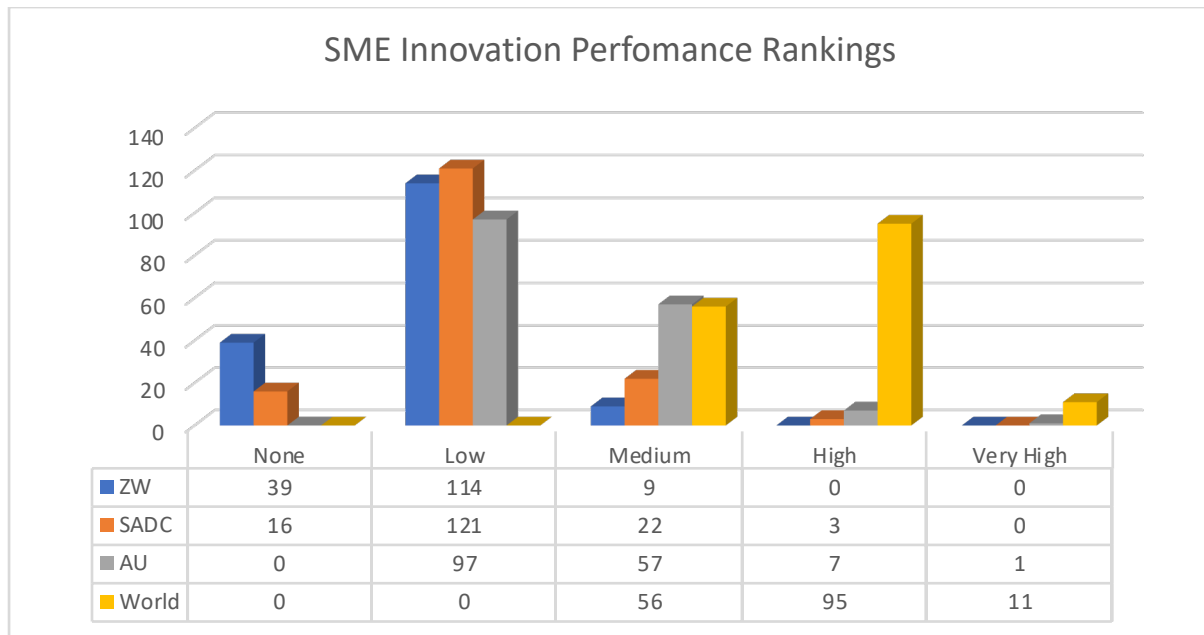


Figure 13 - Innovation Performance Rankings Graph

## 4.5 Structural Equation Modelling

The researcher analysed structural relationships in the study using a multivariate statistical technique known as Structural Equation Modelling shown in Figure 14. The model uses a combination of factor analysis and multiple regression analysis to test the structural relationship between measured variables and latent constructs (Gefen, Straub, & Boudreau, 2000). The tests established that the model explains 72.3% of variance in innovation performance and supported six of the tested relationships as shown in Table 29 based on assessment of  $f^2$  critical values – 0.02, 0.15, 0.35 for weak, moderate and strong effects respectively as recommended by Hair et al. (2017). The model fit indices were as follows: SRMR = 0.128, NFI = 0.60.

Relationship	Std. Beta	Std. Error	t-value	$f^2$ -value	Decision
CA -> IC	-0.024	0.156	0.048	0.000	Not Supported
CLR -> IC	0.162	0.117	1.484	0.017	Supported
CMI -> IC	0.034	0.115	0.176	0.000	Not Supported
FD -> IC	0.364	0.096	3.887	0.108	Supported
OM -> IC	0.138	0.134	0.898	0.012	Not Supported
SF -> IC	0.074	0.158	0.284	0.001	Not Supported

IND -> IC	-0.140	0.103	1.175	0.018	Supported
LE -> IP	-0.009	0.066	0.045	0.000	Not Supported
MEEC -> IP	0.071	0.099	0.530	0.003	Not Supported
FR -> IP	0.025	0.052	0.487	0.002	Not Supported
GP -> IP	-0.006	0.066	0.340	0.001	Not Supported
IC -> IP	0.762	0.061	12.415	1,412	Supported
OD -> IP	-0.100	0.115	1.233	0.049	Supported
PNA -> IP	0.006	0.077	0.097	0.000	Not Supported
Moderating Effect FR -> IP	-0.048	0.053	0.751	0.003	Not Supported
Moderating Effect GP -> IP	-0.001	0.074	0.170	0.000	Not Supported
Moderating Effect LE -> IP	0.005	0.086	0.074	0.000	Not Supported
Moderating Effect MEEC -> IP	0.153	0.113	1.325	0.021	Supported
Moderating Effect OD -> IP	-0.031	0.067	0.036	0.000	Not Supported
Moderating Effect PNA -> IP	0.023	0.064	0.340	0.001	Not Supported

Table 29 - SEM Model Summary

As a result of the SEM being a more robust multivariate test, a number of variables previously highlighted as significant using correlations and simple regression analysis tested insignificant. This is due to the fact that SEM equations represent a causal link rather than a mere empirical association (Freese & Kevern, 2013). Additionally, literature corroborates that SEM has better error handling than first-generation tests. According to Freese & Kevern (2013), “...whereas errors in regular regression equations are by definition orthogonal to the predictors, errors in structural equations may or may not be orthogonal, the status of which constitutes a causal assumption which requires careful substantive deliberation. It is those substantive considerations that endow SEM with causal knowledge, capable of offering policy-related conclusions.” (p. 14). Based on this narrative, it can be deduced that SEM is sensitive to errors that may occur during data collection and analysis. These errors, as well as the recommended sample size (minimum of 200 as a rule of thumb) are plausible explanations for the differences in the observed output (Nachtigall, Kroehne, Funke, & Steyer, 2003).

### SEM Model (t-values)

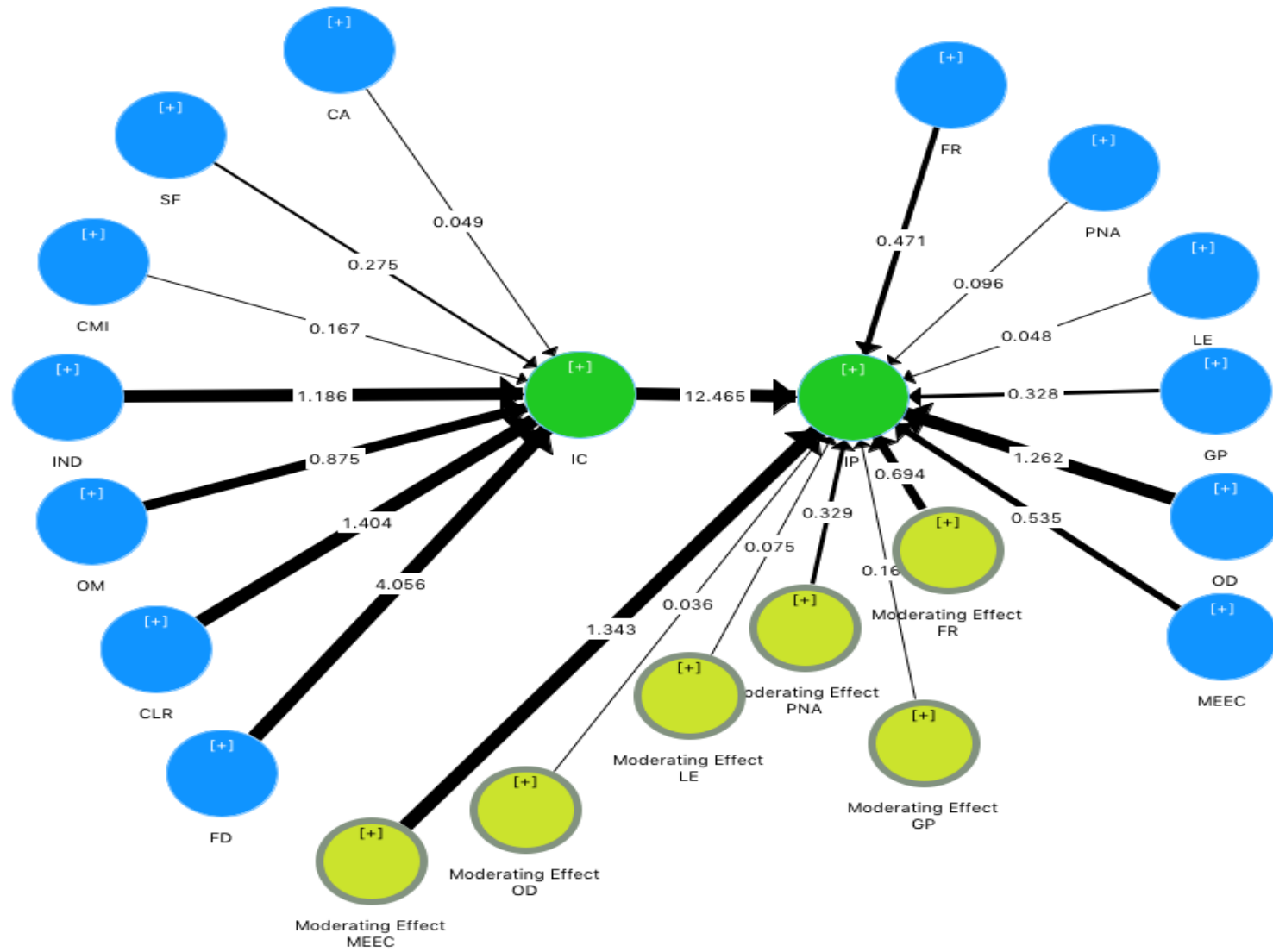


Figure 14 - SEM Model (Revised Model)

## 4.6 Qualitative Analysis

The questionnaire included some open-ended questions that enquired about the participants' opinions on the innovation performance of SMEs in Zimbabwe. The responses were analysed and grouped using thematic analysis. Thematic analysis is a method for identifying, analyzing, and reporting patterns (themes) within data (Braun & Clarke, 2006). It is a widely-used method for qualitative research which was characterised by the following steps: 1. Data Familiarisation 2. Generating initial codes. The researcher used different colour codes to differentiate the varying semantic content in the data 3. Searching for themes 4. Reviewing themes 5. Defining and naming themes 6. Producing the report.

Generally, all the qualitative responses addressed a recurring set of themes which are discussed in the following sections. The observation is that these themes qualify points of ameliorative intervention, through policy or other means. The recurring responses indicate the participants' critical issues that were widely common across the sample.

<b>Policy Interventions Generated</b>	<b>Sample Responses</b>	<b>Number of Respondents</b>
Funding	"Banks must be compelled to open credit lines to SMEs" "Government must subsidise use of ICT by SMEs in a similar model to command agriculture. There must be government financed procurement, training and implementation of ICT in small businesses" "Increase funding opportunities for small businesses" "Introduce a quota system for funding SMEs" "Government can assist in this area by encouraging local banks to work with start-ups and small business by providing loans or investment"	40
Research, Training and Exchange Programs	"Policy that encourages knowledge transfer from developed countries" "Government must make ICT skills compulsory at higher learning levels through managed programs" "Invest in digital innovation hubs" "Policy for teaching of ICT and creation of innovation hubs" "Improve opportunities for knowledge sharing and exchange"	31
Incentives	"Government must adjust tax for small businesses" "Duty free imports on ICT equipment" "Incentives for innovative SMEs"	30

	<p>“Government must provide better support and incentives for small businesses”</p> <p>“Subsidies to SMEs so that they can meet costs of production as well as marketing costs which would make them more competitive”</p>	
Legislative Adjustments	<p>“Enactment of Cyber Laws to protect the ICT environment”</p> <p>“Invest in ICT infrastructure”</p> <p>“POTRAZ must regulate the expensive costs of data”</p> <p>“Government must enact a statutory instrument enforcing use of ICT”</p> <p>“Economic reforms that support SMEs”</p>	25

*Table 30 - Policy Interventions*

Table 30 above summarises the suggested policy interventions required to make digital innovation performance of SMEs in Zimbabwe more competitive to regional and international standards.

<b>Non-policy interventions generated</b>	<b>Sample Responses</b>	<b>Number of Respondents</b>
Funding	<p>“More funding for farmers to access ICT equipment”</p> <p>“Increase government funding for SMEs”</p> <p>“Increase credit lines to small businesses”</p> <p>“Increase funding to small businesses even without collateral”</p> <p>“Availability of capital to diversify our activities”</p>	57
Training and Awareness Programs	<p>“Avail training and advisory services to small businesses”</p> <p>“SMEs should have access to expert consulting and advisory services on using ICT in their business”</p> <p>“More information on digital innovation”</p> <p>“Establishment of digital innovation hubs”</p> <p>“Training of ICT use in business”</p>	55
Legislative Adjustments	<p>“Gazette a board that regulates innovation”</p> <p>“Improved ICT infrastructure”</p> <p>“Regulation of data bundle prices and easy accessibility of internet”</p> <p>“Government must procure ICT equipment to empower small businesses”</p> <p>“Better connectivity in farming areas”</p>	10
Incentives	<p>“Reduce duty on ICT imports”</p> <p>“Support from the government and new media technology”</p>	2

*Table 31 - Non-Policy Interventions*

Table 31 summarises the suggested non-policy interventions that would enable SMEs to produce more or better digital innovations.

Codes Generated	Sample Responses	Number of Respondents
Training and Awareness Programs	“There is a general lack of knowledge around digital innovation” “There is need to facilitate knowledge exchange with other legal firms, locally and abroad” “ICT must be taught at elementary level” “SME owners require exposure to digital innovation and the production of hubs offering training would be useful” “We need to learn more about digital innovation”	42
Legislative Adjustments	“The economy is affecting small businesses” “Government must invest in better technology infrastructure” “Government must prioritise ICT infrastructure” “Government must not politicise development projects” “ZIMRA must adjust taxes for small businesses”	31
Market Needs	“The market is not ready to consume digital products based on my experiences as an online retailer” “The local market is not ready to consume digital products” “The market must adjust to be able to consume digital products”	3

Table 32 - Other Information

Table 32 above summarises other information relating to digital innovation in Zimbabwe’s SMEs.

### Theme 1: Funding

Literature highlights that financial performance drives innovation activity in SMEs (Alqahtani, 2016). The study findings reflect that most enterprises in the country have no access to funding as a result of the economic crisis. Additionally, small businesses do not have the pre-requisite collateral to access loans from funding institutions. Due to this lack of funds, innovation activity is very low. One peculiar suggestion is the introduction of innovation-centered managed programs akin to Command Agriculture<sup>2</sup>. This is one of many anecdotal accounts of the various alternatives to SME financing in Zimbabwe. Access to funding, by the participants’ narrative as shown in Table 31, is the predominant, persistent, barrier to establishing and scaling up commercially viable innovations in SMEs.

<sup>2</sup> A state-led contract farming model to enhance domestic production and reduce food imports.

**Theme 2: Research, Training and Exchange Programs**

Knowledge management is key to enhancing the innovation capacity of a firm (Tsoukatos et al., 2018). It is widely argued that internal innovativeness is largely influenced by the manner in which a business acquires new knowledge, through R&D, and disseminates the same to yield competitive advantage. An effective knowledge management strategy should dictate the right tools, people, knowledge and structures needed to provide superior value to customers (Rautela, 2018). A firm may also acquire new knowledge through exchange programs with firms from advanced economies. These exchange programs are synonymous with academic institutions and can be swiftly adopted for SMEs. A significant portion of the respondents indicated that their firms lacked knowledge management frameworks hence undermining their innovative capacity and performance (Table 31).

**Theme 3: Incentives**

The role of incentives as contingent motivators cannot be disputed (Hamid, 2015). A number of respondents indicated that incentives in the form of tax adjustments and duty-free imports would go a long way in revamping their current business environment (Table 30). Essentially, government acting directly or through proxies, must provide support and incentives for small businesses to be innovative. Literature shows that incentives can cushion SMEs to take on the risk associated with innovation. Furthermore, incentives can cover overheads incurred by small businesses while awaiting to reap the returns of projects with long gestation periods (Rissola & Sörvik, 2018).

**Theme 4: Legislative Adjustments**

Innovation takes place in a digital ecosystem that is enhanced through good policy (Nepelski, 2019). The respondents corroborated this assertion by indicating that their businesses would benefit from legislative adjustments that enhance their innovation capacity (Table 32). The responses indicate that government must prioritise investment in ICT infrastructure to provide SMEs with able digital tools. Furthermore, there was also an indication that the cyberspace is not fully protected by law (Government of Zimbabwe, 2016). Policy makers must gazette policies that revive the economy and empower monitoring boards like POTRAZ to effectively manage ICT and innovation related issues. Other statutory instruments like the enforced use of ICT in business can also help foster innovativeness in SMEs.

### **Theme 5: Market Needs**

Digital innovations emerge in response to opportunities available in the digital ecosystem (Um et al., 2013). These opportunities are a representation of what the market demands at a particular time. Consequently, a laggard market inhibits the rate at which digital innovations can be introduced. The responses indicate that the current market environment is adverse to the introduction of digital products as consumers are still tied to traditional services or lack the means to effectively utilise digital technologies (Um et al., 2013). It was observed that a significant number of firms have had challenges with adamant consumers who blatantly refuse to evolve with digital technology hence resulting in low digital innovation performance of SMEs as a consequence of consumer-driven decisions (Table 32).

## **4.7 Hypothesis Testing**

As indicated earlier the initial model was reviewed during construct validity analysis which led to the formulation of revised hypotheses as described in Table 33 below. The hypotheses were qualified based on the collective outcome of the simple regression analysis, multiple regression and SEM. Ideally, a strong predictor/moderator ought to meet the significance cutoff for all three tests. However, where a variable only satisfied the weaker tests (i.e. correlation or simple regression) the overall outcome was a “Weak Accept” on the respective hypothesis, given the variable manages a satisfactory t-value on the SEM Model. Conversely, variables that were retained as significant in the more robust tests (i.e. multiple regression or structural equation modelling) resulted in an overall outcome of “Accept” on the respective hypothesis.

<b>Code</b>	<b>Hypothesis</b>	<b>Outcome</b>
H1	Competition and Market Information has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Reject
H2	Industry has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Weak Accept
H3	Organisational Management has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Weak Accept
H4	Firm Demographics has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Accept

H5a	Skills Factor has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Reject
H5b	The need for Competitive Advantage has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Reject
H6	Culture has a significant effect on the digital innovation capability of SMEs in Zimbabwe	Accept
H7-1	Market Environment and External Collaboration is a significant moderator of digital innovation performance for SMEs in Zimbabwe	Accept
H7-2	Organisational Dynamics has a significant effect on the digital innovation performance for SMEs in Zimbabwe	Accept
H7-3	The Legal Environment is a significant moderator of digital innovation performance for SMEs in Zimbabwe	Reject
H7-4	Financial Resources is a significant moderator of digital innovation performance for SMEs in Zimbabwe	Weak Accept
H7-5	Platforms for Networking and Access to Digital Innovation is a significant moderator of digital innovation performance for SMEs in Zimbabwe	Weak Accept
H7-6	Government Policy is a significant moderator of digital innovation performance for SMEs in Zimbabwe	Reject

*Table 33 - Hypothesis Testing*

## 4.8 Key Observations and Recommendations

1. SMEs in Zimbabwe currently have low digital innovation capability resulting in low digital innovation performance which cuts across all sectors including government departments.
2. All 5 types of innovation occur in Zimbabwe's SMEs, although process and organisational innovations are far less common. This trend can be attributed to a lack of organisational sophistication – structure, heterogenous composition, cohesion and strategy, in SMEs due to the limited number of employees and clients they service. A good number of SMEs run elementary production processes that dispel the need to introduce process innovations. SME business owners need to be enlightened on the strategic role of digital innovation in setting their businesses onto a positive growth

trajectory and reducing the time and effort required to achieve both administrative and production tasks.

3. There is a general lack of knowledge on digital innovation in Zimbabwe. This is despite the educational demographics analysed in the data that showed a large proportion of the participants hold a minimum of a diploma. This observation points to a need for curriculum reviews to incorporate ICT skills into all main stream learning programs. Government must be at the forefront of pioneering ICT innovation in business through policy and managed exchange programs that facilitate knowledge transfer between local SMEs and those in advanced economies. The establishment of digital innovation hubs is also critical to this strategy to create opportunities for mentorship and access to expert advisory services.
4. A majority of the SMEs participating in the study lack a knowledge management strategy or framework thus hindering their potential to acquire new knowledge, learn new skills or optimise their businesses using ICT. Their current mode of operation is primarily tied to survival in a challenging economic environment, and everything else is secondary. Government must formulate policies that revive the economy and create a propitious environment for SMEs to innovate. The alternative narrative is that SMEs must innovate frugally in the current socio-economic environment as digital innovations are meant to address such challenges.
5. The participant SMEs in Zimbabwe lack financial resources. There must be an urgent intervention by the responsible authorities to ensure that small businesses access lines of credit or grants to subsidise their ICT initiatives, using government securities. The envisaged funding model must be inclusive of the marginalized SMEs in non-metropolitan areas, and free of political connotations.
6. The local market is not yet ready to consume digital products based on the experiences of some SMEs that have attempted to introduce digital products. At the business level it is strategically astute to deliver products that the market demands, even if they may be inconsistent with modern developmental trends. A key influencer in the current market dispensation is the exorbitant data costs and decrepit capital equipment. There must be an effective statutory regulator to monitor internet accessibility and prioritise investment in ICT infrastructure especially in non-metropolitan areas where key economic drivers like agriculture and mining are located.

## 5. Conclusion

This section concludes the research by reviewing the research objectives, research implications, limitations and mapping out a direction for future work.

### 5.1 Research Summary

The main goal of this research was to establish the factors affecting the development of digital innovations in Zimbabwe's SMEs through an objective study based on qualitative and quantitative data. In order to achieve the objectives, the researcher reviewed academic literature on digital innovation and SMEs which set the groundwork for the formulation of a conceptual model that was used to guide the study. The highlight of this model was that innovation performance cannot be achieved without innovation capability. It was therefore imperative to measure both the digital innovation capability and digital innovation performance of SMEs to ascertain a comprehensive status of digital innovation of SMEs in the country.

The main factors that emerged as affecting innovation capability were; lack of information on digital innovation, employee's digital skills and the business sector/industry in which they are operating. The results also show that a significant proportion of the participants perceive digital innovation as exclusive to main-stream technology businesses as shown in Section 4.3.4. Consequently, SMEs in industries like agriculture, mining and manufacturing barely see the need to innovate digitally. Furthermore, they lack knowledge on the particular subject and do not have skillful human resources to champion digital innovation within their respective businesses. With regards to innovation performance, it was established that a majority of businesses do not have adequate financial resources to drive their ICT initiatives. The financial quagmire is aggravated by a critical shortage of ICT related expertise and supporting digital infrastructure in the country as shown in Section 4.4.5.

Generally, the results show that SMEs in Zimbabwe have a low digital innovation capability which results in a low digital innovation performance as shown in Section 4.4.3. The participants suggested policy interventions to remedy the situation including access to funding, training and awareness programs, and facilitation of incentives for SMEs in the form of duty-free imports for ICT equipment and tax reductions or exemptions for innovating SMEs as shown in Section 4.6.

## 5.2 Research Implications

This research established a departure point for future policies whose core obligation is to stimulate sustainable economic development steered by SMEs through digital innovation. For those in academia, in realising that digital innovation is an emerging area of research in information systems, the output of this research is a foundation that can be continuously enhanced to enable a comprehensive narrative on achieving Sustainable Development Goal 9<sup>3</sup>. The findings improve stakeholders' understanding of the factors that affect digital innovation in SMEs in Zimbabwe. The same methodology can be adopted and validated in other similar socio-economic climates.

## 5.3 Research Limitations

One of the main limitations of the research is that digital innovation is an emerging area of research with limited supporting literature. The research exposed a sophistication gap between the research phenomenon and some of the participants, which the researcher had to bridge before administering the questionnaire. Additionally, the respondents were conservative with their comments as to how the political environment may be affecting innovativeness in their firms as they were not comfortable dissecting issues around politicisation of developmental projects. This was a key impediment to building a comprehensive narrative on digital innovation.

## 5.4 Directions for Future Work

Future research work must focus on marginalised groups in non-metropolitan areas. It is plausible that these communities may experience different challenges to their urban-based counterparts. Furthermore, extending the questionnaire to include more qualitative questions will illuminate on more insights that allow researchers to map the pattern of understanding around the research phenomenon and assess the full impact of demographics on the results. It

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<sup>3</sup> The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation (United Nations, 2019).

may also be fruitful to increase the scope of the research to be a comparative study between two or more countries to refute the imposition of blanket development models, or a longitudinal study based on the same phenomenon to examine the impact of the recommended policy adjustments on digital innovation capability and performance. Lastly, future work must investigate the implementation of a frugal innovation performance model to counter the effects of resource constrained environments.

## References

- Adeyeye, A. D., Jegede, O. O., Oluwadare, A. J., & Aremu, F. S. (2015). Micro-level determinants of innovation : analysis of the Nigerian manufacturing sector. *Innovation and Development*, (June), 37–41. <https://doi.org/10.1080/2157930X.2015.1047110>
- African Development Bank Group. (2019). Zimbabwe Economic Outlook | African Development Bank - Building today, a better Africa tomorrow. Retrieved March 23, 2019, from African Development Bank Group website: <https://www.afdb.org/en/countries/southern-africa/south-africa/south-africa-economic-outlook>
- Ajumobi, D. O. (2014). *Matching Human Competencies With Mobile Technology and Business Strategy in Women-Led Smes*. University of Cape Town.
- Al-Jabri, I. M., & Sohail, M. S. (2012). Mobile Banking Adoption: Application of Diffusion of Innovation Theory. *Journal of Electronic Commerce*, 13(4), 379–391.
- Almalki, S. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods Research—Challenges and Benefits. *Journal of Education and Learning*, 5(3), 288–290. <https://doi.org/10.5539/jel.v5n3p288>
- Alqahtani, K. M. (2016). Challenges of Innovation for Chinese Small and Medium-sized Enterprises: Case Study in Beijing. *International Business Research*, 9(12), 165–171. <https://doi.org/10.5539/ibr.v9n12p165>
- Bayarçelik, E. B., Taşel, F., & Apak, S. (2014). A Research on Determining Innovation Factors for SMEs. *Procedia - Social and Behavioral Sciences*, 150, 202–211. <https://doi.org/10.1016/j.sbspro.2014.09.032>
- Berisha, G., & Pula, J. (2015). Defining small and medium enterprises: a critical review. *Academic Journal of Business, Administration, Law and Social Sciences*, 1(1), 17–28.
- Bhattacharjee, A. (2012). Introduction to Research, Social Science Research: Principles, Methods, and Practices. In *Pure and Applied Chemistry*. <https://doi.org/10.1351/pac198961091657>
- Bomani, M., Fields, Z., & Derera, E. (2015). Historical overview of small and medium enterprise policies in Zimbabwe. *Journal of Social Sciences*, 45(2), 113–129. <https://doi.org/10.1080/09718923.2015.11893493>
- Booyens, I. (2011). Are small, medium- and micro-sized enterprises engines of innovation? the reality in South Africa. *Science and Public Policy*, 38(1), 67–78. <https://doi.org/10.3152/030234211X12834251302445>

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Brinkley, I. (2006). *Defining the knowledge economy Knowledge economy programme report*. London.
- Choi, Y. S., & Lim, U. (2017). Contextual factors affecting the innovation performance of manufacturing SMEs in Korea: A structural equation modeling approach. *Sustainability (Switzerland)*, 9(7), 1–15. <https://doi.org/10.3390/su9071193>
- Ciriello, R. F. (2018). *Digital innovation : people , practices , tools*. (October).
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approach* (Fourth). London: SAGE Publications.
- De Beer, J., Millar, P., Mwangi, J., Nzomo, V., & Rutenberg, I. (2017). A framework for assessing technology hubs in Africa. *Journal of Intellectual Property and Entertainment Law*, 6(2), 237–277.
- de Vasconcelos, R. B. B., & de Oliveira, M. R. G. (2018). Determinants of innovation in micro and small enterprises: A management approach. *Journal of Business Management*, 58(4), 349–364. <https://doi.org/10.1590/S0034-759020180402>
- Egbetokun, A., Siyanbola, W., Olamide, O., Irefin, I., & Adeniyi, A. (2008). Innovation in Nigerian SMEs: Types and impact. *National Centre for Technology Management*, (25338).
- Egbetokun, A., Siyanbola, W., Sanni, M., Olamide, O., Adeniyi, A., & Irefin, I. (2008). What Drives Innovation?: Inferences from an Industry-Wide Survey in Nigeria. *National Centre for Technology Management*, (25343).
- FAO. (2020). Zimbabwe at a glance \_ FAO in Zimbabwe \_ Food and Agriculture Organization of the United Nations. Retrieved April 1, 2020, from FAO in Zimbabwe website: <http://www.fao.org/zimbabwe/fao-in-zimbabwe/zimbabwe-at-a-glance/en/>
- Fichman, R. G., Dos Santos, B. L., & Zheng, Z. (Eric). (2017). Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *MIS Quarterly*, 38(2), 329–343. <https://doi.org/10.25300/misq/2014/38.2.01>
- Field, A. (2009). *Discovering Statistics Using SPSS* (Third Edit). [https://doi.org/10.1007/978-0-387-68969-2\\_13](https://doi.org/10.1007/978-0-387-68969-2_13)
- Freese, J., & Keven, J. A. (2013). Handbook of Causal Analysis for Social Research. In *Technical Report R-393* (Vol. 15). <https://doi.org/10.1007/978-94-007-6094-3>
- Gandhi, P., Khanna, S., & Ramaswamy, S. (2016). Which Industries Are the Most Digital (and Why)? Retrieved April 27, 2020, from Harvard Business Review website:

<https://hbr.org/2016/04/a-chart-that-shows-which-industries-are-the-most-digital-and-why>

- Gefen, D., Straub, D., & Boudreau, M. (2000). Structural equation modeling techniques and regression : Guidelines for research practice. *Communications of the Association for Information Systems*, 4(7), 2–5.
- Global Economy. (2019). Zimbabwe Innovation Index. Retrieved March 23, 2019, from The Global Economy website: [https://www.theglobaleconomy.com/Zimbabwe/GII\\_Index/www.globalinnovationindex.org/](https://www.theglobaleconomy.com/Zimbabwe/GII_Index/www.globalinnovationindex.org/)
- Government of Zimbabwe. *Zimbabwe National Policy for Information and Communication Technology*. , (2016).
- Government of Zimbabwe. *Transitional Stabilisation Programme Reforms Agenda: October 2018 - December 2020*. , (2018).
- Hadi, N. U., Abdullah, N., & Ilham, S. (2016). An Easy Approach to Exploratory Factor Analysis : Marketing Perspective. *Journal of Educational and Social Research*, 6(1), 216. <https://doi.org/10.5901/jesr.2016.v6n1p215>
- Hadjimanolis, A. (1999). Barriers to innovation for SMEs in a small less developed country (Cyprus). *Technovation*, 19(9), 561–570. [https://doi.org/10.1016/S0166-4972\(99\)00034-6](https://doi.org/10.1016/S0166-4972(99)00034-6)
- Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management and Data Systems*, 117(3), 442–458. <https://doi.org/10.1108/IMDS-04-2016-0130>
- Hamid, N. (2015). *Tax Incentives and Malaysian SMEs Performance: A Mixed Method Approach* (Universiti Teknologi Mara). Retrieved from [http://ir.uitm.edu.my/id/eprint/15788/1/TP\\_NADIAH ABD HAMID AC 15\\_5.PDF](http://ir.uitm.edu.my/id/eprint/15788/1/TP_NADIAH%20ABD%20HAMID%20AC%2015_5.PDF)
- Haryani, S., & Gupta, V. B. (2016). Factors affecting innovation capability of Indian software firms (with special reference to Indore city). *International Research Journal of Engineering and Technology*, 03(12), 1213–1219. Retrieved from [www.irjet.net](http://www.irjet.net)
- Hayes, A. F. (2017). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach* (Second Edi). <https://doi.org/978-1-60918-230-4>
- Heimonen, T. (2012). What are the factors that affect innovation in growing SMEs? *European Journal of Innovation Management*, 15(1), 122–144.

<https://doi.org/10.1108/14601061211192861>

- Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization*, 28(1), 52–61. <https://doi.org/10.1016/j.infoandorg.2018.02.004>
- ITU. (2017). *Bridging the digital innovation divide: A toolkit for strengthening ICT centric ecosystems*.
- Jackson, D. J. (2011). What is an Innovation Ecosystem? *National Science Foundation, Arlington, VA*, 53(March), 1689–1699. <https://doi.org/10.1017/CBO9781107415324.004>
- Janaratne, N. (2014). A framework for improving innovation capability of SMEs to enhance competitiveness in the digital economy. *27th Annual SEAAZ Conference Proceedings*, 1–12.
- Jegade, O. O. (2012). Factors Influencing Innovation and Competitiveness in the Service Sector in Nigeria: a Sub-Sectoral Approach. *Management*, 2(3), 69–79. <https://doi.org/10.5923/j.mm.20120203.03>
- Jiménez, A., & Zheng, Y. (2018). A Spatial Perspective of Innovation and Development: Innovation Hubs in Zambia and the UK. *International Conference on Social Implications of Computers and Developing Countries*, 171–181. [https://doi.org/https://doi.org/10.1007/978-3-319-59111-7\\_15](https://doi.org/https://doi.org/10.1007/978-3-319-59111-7_15)
- Jun, M. S. (2018). Blockchain government - A next form of infrastructure for the twenty-first century. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(7), 2–12. <https://doi.org/10.1186/s40852-018-0086-3>
- Kayal, A. A. (2008). National innovation systems a proposed framework for developing countries. *International Journal of Entrepreneurship and Innovation Management*, 8(1), 74. <https://doi.org/10.1504/ijeim.2008.018615>
- Kim, M. K., Park, J. H., & Paik, J. H. (2018). Factors influencing innovation capability of small and medium-sized enterprises in Korean manufacturing sector: Facilitators, barriers and moderators. *International Journal of Technology Management*, 76(3–4), 214–235. <https://doi.org/10.1504/IJTM.2018.091286>
- Kohli, R., & Melville, N. P. (2019). Digital innovation: A review and synthesis. *Information Systems Journal*, (29), 200–223.
- Kumar, R. (2011). *Research Methodology: A step by step guide for beginners* (Third Edit). London: SAGE Publications.
- Levers, M. J. D. (2013). Philosophical paradigms, grounded theory, and perspectives on emergence. *SAGE Open*, 3(4), 1–6. <https://doi.org/10.1177/2158244013517243>

- Liu, M., Li, M., & Zhang, T. (2012). Empirical Research on China's SMEs Technology Innovation Engineering Strategy. *Systems Engineering Procedia*, 5, 372–378. <https://doi.org/10.1016/j.sepro.2012.04.058>
- Lund, J. (2014). *Information Systems and Global Assemblages. (Re)Configuring Actors, Artefacts, Organizations*. 446(June). <https://doi.org/10.1007/978-3-662-45708-5>
- Lundvall, B. Å. (2005). National innovation systems - Analytical concept and development tool. *Dynamics of Industry and Innovation*, 14(1), 95–119. <https://doi.org/10.1080/13662710601130863>
- Mafumbate, R., Gondo, T., & Mutekwe, E. (2014). Graduate Employment Challenges in Zimbabwe: A Case of Zimbabwe Open University Graduates. *Journal of Education and Practice*, 5(20), 57–64.
- Maguire, M., & Delahunt, B. (2017). Doing a Thematic Analysis: A Practical, Step-by-Step. *The All Ireland Journal of Teaching and Learning in Higher Education*, 8(3), 3351. Retrieved from <http://ojs.aishe.org/index.php/aishe-j/article/view/335>
- Makanyeza, C., & Dzvuke, G. (2015). The influence of innovation on the performance of small and medium enterprises in Zimbabwe. *Journal of African Business*, 16(1–2), 198–214. <https://doi.org/10.1080/15228916.2015.1061406>
- Mazonde, N. B., & Carmichael, T. (2016). The influence of culture on female entrepreneurs in Zimbabwe. *The Southern African Journal of Entrepreneurship and Small Business Management*, 8(1), 10. <https://doi.org/10.4102/sajesbm.v8i1.101>
- Mbiti, I. M., & Weil, D. (2011). Mobile banking: The impact of M-Pesa in Kenya. In *National Bureau of Economic Research* (No. 17129). <https://doi.org/10.3386/w17129>
- Mercan, B., & Götkas, D. (2011). Components of Innovation Ecosystems. *International Research Journal of Finance and Economics*, 76(76), 102–112. <https://doi.org/10.1450-2887>
- Mudavanhu, V., Bindu, S., Chigusiwa, L., & Muchabaiwa, L. (2011). Determinants of Small and Medium Enterprises Failure in Zimbabwe: a Case Study of Bindura. *International Journal of Economics and Research*, 02(05), 82–89.
- Mungai, P., Jimenez, A., Kleine, D., & Van Belle, J.-P. (2019). Models of innovation in an African context. In *The Role of the Marginalized and Unusual Suspects in the Production of Digital Innovations* (pp. 262–278). Springer Nature Switzerland.
- Munyua, H., Adera, E., & Jensen, M. (2009). Emerging ICTs and their potential in revitalizing small-scale agriculture. *Agricultural Information Worldwide*, 2(1), 3–9. Tokyo.
- Nachtigall, C., Kroehne, U., Funke, F., & Steyer, R. (2003). (Why) Should We Use SEM? Pros and Cons of Structural Equation Modeling. *Methods of Psychological Research*, 8(2), 1–

- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly: IT and Innovation*, 41(March), 223–238. <https://doi.org/10.25300/MISQ/2017/41>
- Nan, W. (Vince), & Markus, M. L. (2019). Is inclusive digital innovation inclusive? An investigation of M-Shwari in Kenya. *IFIP Advances in Information and Communication Technology*, 551, 460–471. [https://doi.org/10.1007/978-3-030-18400-1\\_38](https://doi.org/10.1007/978-3-030-18400-1_38)
- Nepelski, D. (2019). How to Facilitate Digital Innovation in Europe. *Intereconomics*, 54(1), 47–52. <https://doi.org/10.1007/s10272-019-0791-6>
- Ngai, E. W. T., Cheng, T. C. E., & Ho, S. S. M. (2004). Critical success factors of web-based supply-chain management systems: An exploratory study. *Production Planning and Control*, 15(6), 622–630. <https://doi.org/10.1080/09537280412331283928>
- Niebel, T. (2018). ICT and economic growth – Comparing developing, emerging and developed countries. *World Development*, 104(14), 197–211. <https://doi.org/10.1016/j.worlddev.2017.11.024>
- Nnadi, F., Chikaire, J. U., Egwuonwu, H., Echetama, J. ., & Atoma, C. . (2012). ICT for Agriculture Knowledge Management in Nigeria: Lessons and Strategies for Improvement. *Science Journal of Agricultural Research and Management*, 2012, 1–8. <https://doi.org/10.7237/sjarm/192>
- Nyathi, K. A., Nyoni, T., Nyoni, M., & Bonga, W. G. (2018). The Role of Accounting Information in the Success of Small & Medium Enterprises (SMEs) in Zimbabwe: A Case of Harare. *Dynamic Research Journals*, 1(1), 1–15.
- Nylén, D., & Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons*, 58(1), 57–67. <https://doi.org/10.1016/j.bushor.2014.09.001>
- Nyoni, T., & Bonga, W. G. (2018). Anatomy of the Small & Medium Enterprises (SMEs) Critical Success Factors (CSFs) in Zimbabwe: Introducing the 3E Model. *Dynamic Research Journals*, 1(2), 1–18.
- OECD. (1997). *National Innovation Systems*.
- OECD. (2018). *OECD Science, Technology and Innovation Outlook 2018: Adapting to Technological and Societal Disruption*. Paris.
- POTRAZ. (2018). Abridge Postal & Telecommunications sector performance report. In *Postal And Telecommunications sector report*.

- Prajogo, D. I., & Ahmed, P. K. (2006). Innovation Capacity , and Innovation Relationships between innovation stimulus , innovation capacity , and innovation performance. *R&D Management*, 36(5), 499–515. <https://doi.org/10.1111/j.1467-9310.2006.00450.x>
- PWC. (2016). *Industry 4.0:Building the digital enterprise*. Retrieved from [www.pwc.com/industry40](http://www.pwc.com/industry40)
- Ragab, M. A., & Arisha, A. (2017). Research Methodology in Business: A Starter’s Guide. *Management and Organizational Studies*, 5(1), 1–17. <https://doi.org/10.5430/mos.v5n1p1>
- Rautela, N. (2018). *Identification of common factors of innovation in a SMME*. University of Cape Town.
- Rissola, G., & Sörvik, J. (2018). *Digital Innovation Hubs in Smart Specialisation Strategies: Early lessons from European regions*. <https://doi.org/10.2760/475335>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). Understanding research philosophies and approaches to theory development. In *The philosophical underpinnings of business and management* (pp. 122–161). Pearson Education.
- Saunila, M., & Ukko, J. (2012). A conceptual framework for the measurement of innovation capability and its effects. *Baltic Journal of Management*, 7(4), 355–375. <https://doi.org/10.1108/17465261211272139>
- Sözbilir, F. (2018). Innovation Capacity and Innovation Performance in Terms of Educational Level of Managers. *Journal of Business Research*, 10(2), 1–12. <https://doi.org/10.20491/isarder.2018.415>
- Szeto, E. (2000). Innovation capacity: Working towards a mechanism for improving innovation within an inter-organizational network. *TQM Magazine*, 12(2), 149–157. <https://doi.org/10.1108/09544780010318415>
- Talebi, K., Ghavamipour, M., & Irandust, A. (2012). Innovation in Iran ’ s small and medium size enterprises ( SMEs ): Prioritize influence factors affecting innovation of SMEs , using analytic network process ( ANP ) method. *African Journal of Business Management*, 6(43), 10775–10785. <https://doi.org/10.5897/AJBM11.1679>
- Tsokota, T., von Solms, R., & van Greunen, D. (2017). An ict strategy for the sustainable development of the tourism sector in a developing country: A case study of Zimbabwe. *Electronic Journal of Information Systems in Developing Countries*, 78(1), 1–20. <https://doi.org/10.1002/j.1681-4835.2017.tb00573.x>
- Tsoukatos, E., Tabouratzi, E., Vassakis, K., & Lemonakis, C. (2018). Determinants of technological and no-technological innovation in SMEs: the case of Crete. *Global*

- Business and Economic Review*, 20(5/6), 544–557.
- Um, S. Y., Yoo, Y., Wattal, S., Kulathinal, R. J., & Zhang, B. (2013). The architecture of generativity in a digital ecosystem: A network biology perspective. *International Conference on Information Systems (ICIS 2013): Reshaping Society Through Information Systems Design*, 4, 3721–3733.
- UNCTAD. (2018). *Technology and Innovation Report 2018: Harnessing Frontier Technologies for Sustainable Development*.
- UNECA. (2017). Blockchain Technology in Africa. *United Nations Economic Commission for Africa*, (November), 2–4. Retrieved from [https://www.uneca.org/sites/default/files/images/blockchain\\_technology\\_in\\_africa\\_draft\\_report\\_19-nov-2017-final\\_edited.pdf](https://www.uneca.org/sites/default/files/images/blockchain_technology_in_africa_draft_report_19-nov-2017-final_edited.pdf)
- UNESCO. (2014). Zimbabwe \_ UNESCO UIS. Retrieved April 1, 2020, from Zimbabwe Education and Literacy website: <http://uis.unesco.org/en/country/zw?theme=education-and-literacy>
- UNIDO. (2015). *The Role of Technology and Innovation in Inclusive and Sustainable Industrial Development*. Vienna.
- United Nations. (2019). The Sustainable Development Goals Report 2019. In *Department of Economic and Social Affairs*. Retrieved from <https://undocs.org/E/2019/68>
- Wang, P. (2009). An Integrative Framework for Understanding the Innovation Ecosystem. *Advancing the Study of Innovation and Globalization in Organisations*, 301–314.
- Wilson, S. (2001). What is indigenous research methodology? *Canadian Journal of Native Education*, 25(2), 166–174. Retrieved from [https://www.researchgate.net/profile/Shawn\\_Wilson2/publication/234754037\\_What\\_Is\\_an\\_Indigenous\\_Research\\_Methodology/links/0a85e5320f48b8d0a3000000.pdf](https://www.researchgate.net/profile/Shawn_Wilson2/publication/234754037_What_Is_an_Indigenous_Research_Methodology/links/0a85e5320f48b8d0a3000000.pdf)
- World Bank. (2019a). The World Bank in China. Retrieved June 20, 2019, from <https://www.worldbank.org/en/country/china/overview>
- World Bank. (2019b). The World Bank in Kenya. Retrieved August 4, 2019, from Web website: <https://www.worldbank.org/en/country/kenya>
- World Bank. (2019c). The World Bank in Zimbabwe. Retrieved August 4, 2019, from Web website: <https://www.worldbank.org/en/country/zimbabwe>
- Yan, S. (2015). A Theoretical Framework of Competitive Advantage for SMEs in China Under New Normal Economy. *European Scientific Journal*, 11(34), 1–12.
- Yoo, Y., Lyytinen, K. J., Boland, R. J., & Berente, N. (2010). The Next Wave of Digital Innovation: Opportunities and Challenges: A Report on the Research Workshop “Digital

- Challenges in Innovation Research.” *Ssrn*, (June). <https://doi.org/10.2139/ssrn.1622170>
- Zangirolami-Raimundo, J., & Oliveira, J. De. (2018). Research methodology topics : Cross-sectional studies. *Journal of Human Growth and Development*, 28(3), 356–360.
- Ziaie, P. (2013). Challenges and issues of ICT industry in developing countries based on a case study of the barriers and the potential solutions for ICT deployment in Iran. *International Conference on Computer Applications Technology, ICCAT 2013*, (October). <https://doi.org/10.1109/ICCAT.2013.6521973>

## Appendix A – SME Defining Metrics

<b>Base</b>	<b>Range</b>	<b>Points</b>	<b>Factor</b>
Employment levels	Up to 5 employees	1	A
	6 – 40 employees	2	
	41 – 75 employees	3	
	76 & above employees	4	
Annual Turnover	Up to \$50 000	1	B
	\$50 001 - \$500 000	2	
	\$500 001 - \$1 000 000	3	
	\$1 000 001 & above	4	
Gross value of assets	Up to \$50 000	1	C
	\$50 001 - \$1 000 000	2	
	\$1 000 001 - \$2 000 000	3	
	\$2 000 001 & above	4	

Table 34 - ZIMRA SME Defining Metrics. Source: (Nyoni & Bonga, 2018)

Any enterprise with a score below 7 points, as classified by ZIMRA, falls within the category of SMEs.

## Appendix B - Questionnaire



### Department of Information Systems

Leslie Commerce Building  
Engineering Mall, Upper Campus  
OR  
Private Bag X3 - Rondebosch - 7701  
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280  
Internet: <http://www.commerce.uct.ac.za/informationssystemsf/>

11 November 2019

Dear Sir/Madam

I am a student enrolled in the Master's Degree in Information Systems at the University of Cape Town. In fulfilment of the requirements of this programme, I am required to conduct research relating to Information Systems.

The purpose of my chosen research is to identify the factors affecting the development of digital innovations in Zimbabwe's SMEs. SMEs play a central role in the evolution of industries as seedbeds of business growth, innovation, and pillars of employment creation in this fourth industrial revolution, where digital technologies and innovation are widely regarded as de facto enablers of socio-economic development. Consequently, this research aims to identify the salient issues affecting digital innovations and guide policy interventions to remedy these challenges.

Your participation in this research is voluntary. All information will be handled in strict confidentiality and used exclusively for the purpose of this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research standards.

The questionnaire for this study has been approved by the UCT Ethics Committee and should take approximately 20 minutes to complete. The findings of this study will be captured in a report that will be presented to the University of Cape Town for academic purposes and may be published in an academic journal or presented at a conference if deemed necessary. If you are willing to participate in this study, kindly sign the attached form and return it to me at your earliest convenience.

Your participation in this study would be greatly appreciated, but is entirely voluntary. Should you have any questions regarding this research, or would like to receive a copy of the consolidated research report, please feel free to contact me on the details below.

Thank you for your time.

Sincerely,

Signature Removed

Tafara Vakirayi

Researcher  
Department of Information Systems  
University of Cape Town

Email: [vkrtaf001@myuct.ac.za](mailto:vkrtaf001@myuct.ac.za)

Signature Removed

Prof. Jean-Paul Van Belle

Research Supervisor  
Department of Information Systems  
University of Cape Town

Email: [Jean-Paul.VanBelle@uct.ac.za](mailto:Jean-Paul.VanBelle@uct.ac.za)

## **Introduction**

SMEs play a central role in the evolution of industries as seed-beds of business growth, innovation, and pillars of employment creation in this fourth industrial revolution, where digital technologies and innovation are widely regarded as de facto enablers of socio-economic development (Kohli & Melville, 2019). Consequently, this research aims to highlight the salient issues affecting digital innovations Zimbabwe's SMEs and guide policy interventions to remedy these challenges, and mobilize domestic innovative potential to develop organic solutions to domestic challenges. This sentiment is echoed for developing countries in order to bridge the burgeoning digital divide (OECD, 2018).

## **Definitions:**

1. Digital innovation is defined as *"a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT"* (Fichman, Dos Santos, & Zheng, 2017).
2. Digital innovation capacity is the overall capability of firms to generate innovation for developing new products to meet market needs (Szeto, 2000).
3. Digital innovation performance involves utilising innovation capacity for optimum business results through creation of new products or provision of improved services (Nambisan, Lyytinen, Majchrzak, & Song, 2017).

**Part A: Demographic Data**

Please tick one position:  Business owner  Business Partner  Business Manager  Other – Please specify \_\_\_\_\_

Your current age:  < 21  21 – 30  31 – 40  41-50  > 50

Your gender:  Female  Male  Prefer not to say

Please state your type of business or the type of sector it falls under: \_\_\_\_\_

Age of Business:  Less than one year  1 - 2  3 - 5  6 - 9  10 and above

Number of employees:  up to 5  6 - 10  11 - 20  21-50  51 and above

Educational Qualification:  High School Certificate  Vocational Certificate  Diploma  University Degree

**Part B: Measuring Digital Innovation Capability**

Please rate (by marking an 'x') your firm's capacity to introduce any of the following innovations enabled by IT during the period 2014 to 2019

Item	1 None	2 Low	3 Moderate	4 High	5 Very High
New or significantly improved methods of manufacturing or producing goods or services (process innovations)					
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing					
New or significantly improved marketing or distribution methods for your inputs, goods or services (marketing innovations)					
New or significantly improved goods					
New or significantly improved services					
New business practices using digital technologies					
New methods of organizing work responsibilities and decision making					
New methods for organizing external relations with other firms, institutions, suppliers or customers					
Other (please specify)					

Kindly indicate (by marking an 'x') the impact of the factors below on your firm's digital innovation capability. In the last column, kindly indicate which THREE factors are most important to your firm using a scale of 1-3 (1 = extremely important, 2 = highly important, 3 = important).

Factors	1 None	2 Low	3 Medium	4 High	5 Very High	Most Important Factor
Size of firm						
Age of firm						
Business sector/industry						
Employee average age						
Organisation culture and beliefs						
No rewarding system for digital innovations						
Employee's ability to work together						
Organisation hierarchy/structure						
Organisation risk attitude						
Management strategy in business operations						
Frequency of change in management						
Management awareness and support						
Management digital competencies						
Lack of suitably qualified personnel						
Lack of information on digital innovation						
Lack of information on market trends						
Lack of proper knowledge management framework						
Lack of research and development strategy						
Lack of knowledge on competitor behavior						
Ability to acquire new knowledge						
Level of education of employees						
Relevance of national curriculum						
Employee's digital skills						
Need to leverage digital innovations for competitive advantage						
Other alternatives for competitive advantage						
Pressure from competitors						
Other (please specify)						

### Part C: Measuring Digital Innovation Performance

During the period 2014 to 2019 how often did your firm introduce any of the following innovations enabled by IT?

Item	1 Never	2 Seldom	3 Sometimes	4 Often	5 Very Often
New or significantly improved methods of manufacturing or producing goods or services (process innovations)					
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing					
New or significantly improved marketing or distribution methods for your inputs, goods or services (marketing innovations)					
New or significantly improved goods					
New or significantly improved services					
New business practices using digital technologies					
New methods of organizing work responsibilities and decision making					
New methods for organizing external relations with other firms, institutions, suppliers or customers					
Other (please specify)					

Kindly indicate (by marking an 'x') the impact of the factors below on your firm's ability to convert digital innovation capability into actual innovation performance. In the last column, kindly indicate which THREE factors are most important to your firm using a scale of 1-3 (1 = extremely important, 2 = highly important, 3 = important).

Factors	1 None	2 Low	3 Medium	4 High	5 Very High	Most Important Factor
Lack of funds within your organisation						
Lack of finance from external sources						
Costs of digital innovations						
Availability of digital innovation platform						
Availability of digital innovation hubs						
Protection of intellectual property rights						
Government policy and politics						
Existence of supporting legal framework						
Availability of government incentives and support						
Management strategy in business operations						
Frequency of change in management						
Management awareness and support						
Management digital competencies						
Availability of able technology infrastructure						
Dynamic nature of digital technologies						
Level IT skills/expertise						
Uncertain demand for digital good/services						
Consumer expectations are too high						
Consumers prefer imported digital goods/services						
Consumers prefer traditional goods/ services						
Market dominated by established enterprises/imports						
Market demand to justify the investment						
Availability of suitable market strategy						
Availability of similar goods/services						
Opportunities for collaboration with other firms and suppliers of equipment, materials and components						
Opportunities for interaction with universities and research institutions						
Availability of professional and industry associations						
Opportunities for interaction with customers or clients						
Other (please specify)						

On a scale of 1-5, how do you rate the average digital innovation performance of SMEs?

Region	1 None	2 Low	3 Medium	4 High	5 Very High
Zimbabwe (Local)					
Southern Africa (SADC)					
Rest of Africa					
Globally					

What specific *government policy interventions* do you think are required to make digital innovation performance of SMEs in Zimbabwe more competitive to regional and international standards?

Apart from *policy interventions*, what would be the single biggest change that would enable your (and other) SMEs to produce more or better digital innovations?"

Please provide any other information you would like to add relating to digital innovation in Zimbabwe's SMEs?

Thank you for you completing this questionnaire. If you would like to receive a summary of the results, please provide your email address below. Alternatively, contact the researcher in 12 months' time.

Email Address: \_\_\_\_\_

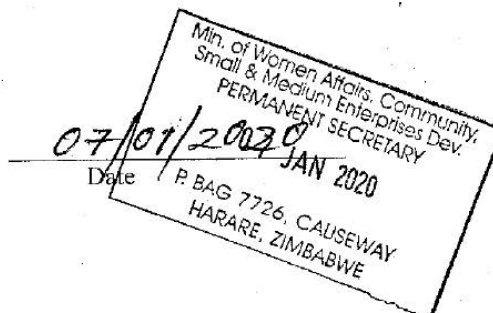
# Appendix C – SME Board Approval

## Consent Form

I, FRANCIS GONDO, consent to the researcher carrying out his study in local SMEs. I am aware that participation is voluntary and respondents may choose to withdraw from this study at any time.

Signature Removed

\_\_\_\_\_  
Signature



## Appendix D – Ethics Approval



### Faculty of Commerce

Private Bag X3, Rondebosch, 7701  
2.26 Leslie Commerce Building, Upper Campus  
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369  
E-mail: [com-faculty@uct.ac.za](mailto:com-faculty@uct.ac.za)  
Internet: [www.uct.ac.za](http://www.uct.ac.za)



@Commerce UCT



UCT Commerce Faculty Office

29/11/2019

Tafara Vakirayi

Department of Information Systems

University of Cape Town

REF: REC 2019/011/035

Investigating the factors affecting the development of digital innovations in Zimbabwe's SMEs

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid until 30 November 2020

Your clearance may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

Signature 2019.11.29  
Removed 15:35:40 +02'00'

Jacques Rousseau  
Commerce Research Ethics Chair  
University of Cape Town  
Commerce Faculty Office  
Room 2.26 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 2695 / 4375

Office Fax: +27 (0)21 650 4369

E-mail: [com-faculty@uct.ac.za](mailto:com-faculty@uct.ac.za)

Website: <https://www.commerce.uct.ac.za/Pages/Ethics-in-Research>

## Appendix E – Distribution Statistics

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
ICP1	162	1,94	1	4	0,95
ICP2	162	2,17	1	5	0,89
ICP3	162	2,67	1	5	0,97
ICP4	162	1,97	1	5	1,14
ICP5	162	2,45	1	5	1,11
ICP6	162	2,53	1	5	0,97
ICP7	162	2,02	1	5	1,11
ICP8	162	2,06	1	5	1,15

Table 35 - ICP Distribution Stats.

## Appendix F – Distribution Statistics

Construct	Test Item Code	Valid N	Mean	Minimum	Maximum	Std.Dev.
Firm Demographics	ICF1	162	2,24	1	5	0,95
	ICF2	162	2,44	1	5	1,00
	ICF3	162	4,10	1	5	1,01
	ICF4	162	2,51	1	5	0,93
Culture	ICF5	162	3,02	1	5	0,99
	ICF6	162	2,59	1	5	1,02
	ICF7	162	2,62	1	5	1,00
	ICF8	162	2,64	1	5	1,00
	ICF9	162	3,62	1	5	1,03
Organisational Management	ICF10	162	3,59	1	5	0,92
	ICF11	162	2,24	1	5	1,01
	ICF12	162	3,48	1	5	1,05
	ICF13	162	3,68	1	5	0,94
Knowledge Management	ICF14	162	3,57	1	5	1,14
	ICF15	162	3,86	1	5	1,10
	ICF16	162	2,78	1	5	0,96
	ICF17	162	2,59	1	5	1,04
	ICF18	162	2,66	1	5	1,00
	ICF19	162	2,31	1	5	0,99

	ICF20	162	2,65	1	5	1,04
Education	ICF21	162	2,77	1	5	0,95
	ICF22	162	2,59	1	5	0,96
	ICF23	162	3,97	1	5	1,16
Competitive Advantage	ICF24	162	2,57	1	5	0,90
	ICF25	162	2,46	1	5	0,96
	ICF26	162	2,33	1	5	0,93

*Table 36 - Innovation Capability Factors Distribution Stats*

## Appendix G – Factor Analysis IC

Variable	Factor Loadings IC (Varimax normalized)					
	Extraction: Principal components (Marked loadings are >,5000)					
	Factor (1)	Factor (2)	Factor (3)	Factor (4)	Factor (5)	Factor (6)
Size of firm	0,2905	-0,1443	-0,0859	<b>0,7986</b>	0,2889	0,1680
Age of firm	0,2408	-0,0166	0,0005	<b>0,8333</b>	0,3091	0,1366
Business sector/industry	0,0339	<b>0,6739</b>	0,3496	-0,0688	0,1714	-0,1411
Employee average age	0,2373	0,1698	-0,0443	0,4770	0,1523	<b>0,6311</b>
Organisation culture and beliefs	0,0916	0,0406	0,3357	-0,0666	0,2075	<b>0,7493</b>
No rewarding system for digital innovations	0,2371	-0,0570	0,2308	0,2728	0,2403	<b>0,7068</b>
Employee's ability to work together	0,3226	-0,0737	0,2828	0,2041	<b>0,5198</b>	0,4839
Organisation hierarchy/structure	0,3292	0,0307	0,3104	0,1431	0,4099	<b>0,5562</b>
Organisation risk attitude	0,0643	0,2609	<b>0,7688</b>	-0,1706	0,2133	0,2031
Management strategy in business operations	0,1630	0,1850	<b>0,6964</b>	0,0459	0,2466	0,1906
Frequency of change in management	<b>0,5829</b>	-0,0594	0,2642	0,2604	0,3167	0,1364
Management awareness and support	0,2053	0,1291	<b>0,8056</b>	-0,0079	0,0538	0,1976
Management digital competencies	0,1309	0,3673	<b>0,7510</b>	0,0499	-0,0512	0,0811
Lack of suitably qualified personnel	0,1587	<b>0,7517</b>	0,2633	-0,0273	-0,0183	0,2590
Lack of information on digital innovation	0,2132	<b>0,8376</b>	0,0679	-0,0959	0,0266	-0,0228
Lack of information on market trends	<b>0,7516</b>	0,3294	0,1094	0,1581	0,1667	0,0380
Lack of proper knowledge management framework	<b>0,8067</b>	0,1783	0,1624	0,0977	0,3097	0,1383

Lack of research and development strategy	0,7701	0,1692	0,1784	0,0906	0,1988	0,3042
Lack of knowledge on competitor behaviour	0,7572	0,0617	0,1149	0,2185	0,3318	0,1614
Ability to acquire new knowledge	0,2899	0,1271	0,2811	0,1240	0,6471	0,1498
Level of education of employees	0,1198	0,3872	-0,0019	0,2304	0,6664	0,1784
Relevance of national curriculum	0,2071	0,0849	0,1981	0,2242	0,7206	0,1928
Employee's digital skills	0,0443	0,6855	0,4300	0,1225	0,2894	-0,0043
Need to leverage digital innovations for competitive advantage	0,5437	0,0691	0,0570	0,2191	0,5865	0,2389
Other alternatives for competitive advantage	0,4728	0,0721	0,0504	0,1648	0,6959	0,1279
Pressure from competitors	0,4815	0,0083	0,0528	0,1062	0,6791	0,2019
<b>Expl.Var</b>	4,2535	2,8654	3,3017	2,1276	4,0124	2,6239
<b>Prp.Totl</b>	0,1636	0,1102	0,1270	0,0818	0,1543	0,1009

Table 37 - Factor Loadings ICF

## Appendix H – Correlations Matrix IC

Variable	Correlations IC Test Items														
	Marked correlations are significant at $p < ,0500$ N=162 (Casewise deletion of missing data)														
	Means	Std.Dev.	IC	FD1	FD2	CLR1	CLR2	CLR3	CLR4	OM1	OM2	OM3	OM4	IND1	IND2
IC	2,2261	0,8688	1,0000	0,5069	0,4738	0,3890	0,2371	0,4021	0,3950	0,1055	0,2228	0,1280	-0,0672	-0,0433	-0,0474
FD1	2,2407	0,9510	0,5069	1,0000	0,8070	0,5159	0,1859	0,4416	0,3926	-0,1228	0,0999	0,0091	-0,0449	-0,0895	-0,0598
FD2	2,4383	1,0027	0,4738	0,8070	1,0000	0,4946	0,1913	0,4434	0,4258	-0,0137	0,1701	0,0839	0,0380	-0,0369	0,0450
CLR1	2,5062	0,9275	0,3890	0,5159	0,4946	1,0000	0,3807	0,5943	0,4939	0,1556	0,2242	0,1783	0,1442	0,0060	0,2708
CLR2	3,0185	0,9936	0,2371	0,1859	0,1913	0,3807	1,0000	0,5475	0,5561	0,4266	0,4281	0,4369	0,3774	0,0910	0,2878
CLR3	2,5926	1,0188	0,4021	0,4416	0,4434	0,5943	0,5475	1,0000	0,6328	0,3272	0,4206	0,4018	0,1733	0,0212	0,1819
CLR4	2,6358	1,0016	0,3950	0,3926	0,4258	0,4939	0,5561	0,6328	1,0000	0,4392	0,4943	0,3891	0,2896	0,1646	0,2996
OM1	3,6235	1,0277	0,1055	-0,1228	-0,0137	0,1556	0,4266	0,3272	0,4392	1,0000	0,6727	0,6545	0,6049	0,4367	0,4898
OM2	3,5864	0,9234	0,2228	0,0999	0,1701	0,2242	0,4281	0,4206	0,4943	0,6727	1,0000	0,5230	0,5453	0,3302	0,3463

OM3	3,4753	1,0527	0,1280	0,0091	0,0839	0,1783	0,4369	0,4018	0,3891	0,6545	0,5230	1,0000	0,6549	0,3643	0,3938
OM4	3,6790	0,9435	-0,0672	-0,0449	0,0380	0,1442	0,3774	0,1733	0,2896	0,6049	0,5453	0,6549	1,0000	0,3983	0,5151
IND1	4,0988	1,0106	-0,0433	-0,0895	-0,0369	0,0060	0,0910	0,0212	0,1646	0,4367	0,3302	0,3643	0,3983	1,0000	0,5078
IND2	3,5741	1,1356	-0,0474	-0,0598	0,0450	0,2708	0,2878	0,1819	0,2996	0,4898	0,3463	0,3938	0,5151	0,5078	1,0000
IND3	3,9691	1,1552	0,0294	0,0294	0,1780	0,1770	0,2494	0,1687	0,3284	0,5186	0,5003	0,4361	0,5266	0,5826	0,5960
CMI1	2,7778	0,9588	0,1856	0,3179	0,3410	0,3787	0,1804	0,3264	0,4003	0,2676	0,3375	0,2653	0,2983	0,2792	0,3176
CMI2	2,5864	1,0434	0,3128	0,4202	0,4118	0,3589	0,3369	0,4306	0,5087	0,2999	0,3951	0,3780	0,2744	0,2569	0,2803
CMI3	2,6605	1,0041	0,2941	0,3398	0,3769	0,4658	0,3737	0,5075	0,5989	0,2726	0,3969	0,4122	0,3366	0,2108	0,3027
CMI4	2,3148	0,9936	0,3838	0,4912	0,4778	0,4663	0,2898	0,4036	0,5466	0,2506	0,3120	0,2896	0,2277	0,1235	0,3012
SF1	2,6173	0,9977	0,4695	0,5101	0,4667	0,4858	0,5648	0,6522	0,6987	0,3614	0,4069	0,4167	0,2184	0,1671	0,1567
SF2	2,6481	1,0424	0,3276	0,3366	0,3624	0,4359	0,3122	0,4198	0,5428	0,3858	0,4093	0,3911	0,2823	0,3162	0,2452
SF3	2,7716	0,9541	0,1517	0,3485	0,4169	0,4263	0,2862	0,3574	0,4064	0,2348	0,3363	0,1830	0,2079	0,2361	0,2823
SF4	2,5926	0,9559	0,2995	0,4092	0,4661	0,4372	0,3546	0,4663	0,5447	0,3360	0,3568	0,3048	0,2536	0,1641	0,1596
CA1	2,5741	0,9041	0,3764	0,5245	0,5703	0,4439	0,3684	0,4982	0,5890	0,2274	0,3829	0,2271	0,1446	0,1279	0,2154
CA2	2,4568	0,9594	0,3206	0,4846	0,5073	0,3737	0,2908	0,4585	0,5426	0,2322	0,3127	0,2449	0,1150	0,1646	0,2253
CA3	2,3272	0,9314	0,3801	0,4926	0,4308	0,3967	0,3827	0,4163	0,5413	0,2593	0,3172	0,2205	0,1627	0,0710	0,1972
<b>Variable</b>	<b>Means</b>	<b>Std.Dev.</b>	<b>IND3</b>	<b>CMI1</b>	<b>CMI2</b>	<b>CMI3</b>	<b>CMI4</b>	<b>SF1</b>	<b>SF2</b>	<b>SF3</b>	<b>SF4</b>	<b>CA1</b>	<b>CA2</b>	<b>CA3</b>	
IC	2,2261	0,8688	0,0294	0,1856	0,3128	0,2941	0,3838	0,4695	0,3276	0,1517	0,2995	0,3764	0,3206	0,3801	
FD1	2,2407	0,9510	0,0294	0,3179	0,4202	0,3398	0,4912	0,5101	0,3366	0,3485	0,4092	0,5245	0,4846	0,4926	
FD2	2,4383	1,0027	0,1780	0,3410	0,4118	0,3769	0,4778	0,4667	0,3624	0,4169	0,4661	0,5703	0,5073	0,4308	
CLR1	2,5062	0,9275	0,1770	0,3787	0,3589	0,4658	0,4663	0,4858	0,4359	0,4263	0,4372	0,4439	0,3737	0,3967	
CLR2	3,0185	0,9936	0,2494	0,1804	0,3369	0,3737	0,2898	0,5648	0,3122	0,2862	0,3546	0,3684	0,2908	0,3827	
CLR3	2,5926	1,0188	0,1687	0,3264	0,4306	0,5075	0,4036	0,6522	0,4198	0,3574	0,4663	0,4982	0,4585	0,4163	
CLR4	2,6358	1,0016	0,3284	0,4003	0,5087	0,5989	0,5466	0,6987	0,5428	0,4064	0,5447	0,5890	0,5426	0,5413	
OM1	3,6235	1,0277	0,5186	0,2676	0,2999	0,2726	0,2506	0,3614	0,3858	0,2348	0,3360	0,2274	0,2322	0,2593	
OM2	3,5864	0,9234	0,5003	0,3375	0,3951	0,3969	0,3120	0,4069	0,4093	0,3363	0,3568	0,3829	0,3127	0,3172	
OM3	3,4753	1,0527	0,4361	0,2653	0,3780	0,4122	0,2896	0,4167	0,3911	0,1830	0,3048	0,2271	0,2449	0,2205	
OM4	3,6790	0,9435	0,5266	0,2983	0,2744	0,3366	0,2277	0,2184	0,2823	0,2079	0,2536	0,1446	0,1150	0,1627	
IND1	4,0988	1,0106	0,5826	0,2792	0,2569	0,2108	0,1235	0,1671	0,3162	0,2361	0,1641	0,1279	0,1646	0,0710	
IND2	3,5741	1,1356	0,5960	0,3176	0,2803	0,3027	0,3012	0,1567	0,2452	0,2823	0,1596	0,2154	0,2253	0,1972	
IND3	3,9691	1,1552	1,0000	0,3807	0,3191	0,3229	0,2358	0,2807	0,3468	0,4782	0,3429	0,3085	0,2986	0,2750	
CMI1	2,7778	0,9588	0,3807	1,0000	0,7333	0,6631	0,6542	0,3910	0,4371	0,4195	0,4496	0,5350	0,4486	0,4784	

CMI2	2,5864	1,0434	0,3191	0,7333	1,0000	0,7840	0,7315	0,5809	0,5107	0,4349	0,4963	0,6680	0,6366	0,6258	
CMI3	2,6605	1,0041	0,3229	0,6631	0,7840	1,0000	0,6868	0,5267	0,4964	0,4243	0,4374	0,6539	0,5746	0,5379	
CMI4	2,3148	0,9936	0,2358	0,6542	0,7315	0,6868	1,0000	0,5609	0,5394	0,4367	0,5021	0,6618	0,6236	0,6733	
SF1	2,6173	0,9977	0,2807	0,3910	0,5809	0,5267	0,5609	1,0000	0,5923	0,4296	0,5910	0,6720	0,5601	0,6035	
SF2	2,6481	1,0424	0,3468	0,4371	0,5107	0,4964	0,5394	0,5923	1,0000	0,4995	0,6157	0,6045	0,6337	0,5159	
SF3	2,7716	0,9541	0,4782	0,4195	0,4349	0,4243	0,4367	0,4296	0,4995	1,0000	0,5988	0,4770	0,5422	0,5879	
SF4	2,5926	0,9559	0,3429	0,4496	0,4963	0,4374	0,5021	0,5910	0,6157	0,5988	1,0000	0,5957	0,6038	0,6181	
CA1	2,5741	0,9041	0,3085	0,5350	0,6680	0,6539	0,6618	0,6720	0,6045	0,4770	0,5957	1,0000	0,7484	0,7197	
CA2	2,4568	0,9594	0,2986	0,4486	0,6366	0,5746	0,6236	0,5601	0,6337	0,5422	0,6038	0,7484	1,0000	0,7284	
CA3	2,3272	0,9314	0,2750	0,4784	0,6258	0,5379	0,6733	0,6035	0,5159	0,5879	0,6181	0,7197	0,7284	1,0000	

Table 38 - Correlations Matrix IC Test Items

## Appendix I – Spearman-R IC

Pair of Variables	Spearman Rank Order Correlations IC MD pairwise deleted Marked correlations are significant at p <,0500			
	Valid (N)	Spearman (R)	t(N-2)	p-value
IC & FD	162	0,5261	7,8257	0,0000
IC & CLR	162	0,4235	5,9140	0,0000
IC & OM	162	0,1261	1,6082	0,1098
IC & IND	162	-0,0286	-0,3622	0,7177
IC & CMI	162	0,3176	4,2371	0,0000
IC & SF	162	0,3638	4,9396	0,0000
IC & CA	162	0,3866	5,3021	0,0000
FD & IC	162	0,5261	7,8257	0,0000
FD & CLR	162	0,4855	7,0239	0,0000
FD & OM	162	0,0051	0,0647	0,9485
FD & IND	162	-0,0111	-0,1408	0,8882
FD & CMI	162	0,4269	5,9708	0,0000
FD & SF	162	0,5293	7,8916	0,0000
FD & CA	162	0,5679	8,7278	0,0000
CLR & IC	162	0,4235	5,9140	0,0000
CLR & FD	162	0,4855	7,0239	0,0000
CLR & OM	162	0,4144	5,7601	0,0000
CLR & IND	162	0,2757	3,6281	0,0004
CLR & CMI	162	0,6007	9,5046	0,0000
CLR & SF	162	0,6332	10,3488	0,0000
CLR & CA	162	0,5886	9,2089	0,0000
OM & IC	162	0,1261	1,6082	0,1098
OM & FD	162	0,0051	0,0647	0,9485
OM & CLR	162	0,4144	5,7601	0,0000
OM & IND	162	0,5607	8,5647	0,0000
OM & CMI	162	0,3770	5,1487	0,0000
OM & SF	162	0,3659	4,9739	0,0000
OM & CA	162	0,2030	2,6225	0,0096
IND & IC	162	-0,0286	-0,3622	0,7177
IND & FD	162	-0,0111	-0,1408	0,8882
IND & CLR	162	0,2757	3,6281	0,0004
IND & OM	162	0,5607	8,5647	0,0000
IND & CMI	162	0,3615	4,9050	0,0000
IND & SF	162	0,3904	5,3631	0,0000
IND & CA	162	0,2406	3,1361	0,0020
CMI & IC	162	0,3176	4,2371	0,0000
CMI & FD	162	0,4269	5,9708	0,0000
CMI & CLR	162	0,6007	9,5046	0,0000
CMI & OM	162	0,3770	5,1487	0,0000
CMI & IND	162	0,3615	4,9050	0,0000
CMI & SF	162	0,6615	11,1573	0,0000
CMI & CA	162	0,7238	13,2692	0,0000
SF & IC	162	0,3638	4,9396	0,0000

SF & FD	162	0,5293	7,8916	0,0000
SF & CLR	162	0,6332	10,3488	0,0000
SF & OM	162	0,3659	4,9739	0,0000
SF & IND	162	0,3904	5,3631	0,0000
SF & CMI	162	0,6615	11,1573	0,0000
SF & CA	162	0,7567	14,6391	0,0000
CA & IC	162	0,3866	5,3021	0,0000
CA & FD	162	0,5679	8,7278	0,0000
CA & CLR	162	0,5886	9,2089	0,0000
CA & OM	162	0,2030	2,6225	0,0096
CA & IND	162	0,2406	3,1361	0,0020
CA & CMI	162	0,7238	13,2692	0,0000
CA & SF	162	0,7567	14,6391	0,0000

Table 39 - Spearman-R Correlations IC

## Appendix J – Distribution Statistics

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
IPP1	162	1,75	1	5	1,06
IPP2	162	2,00	1	5	1,23
IPP3	162	2,28	1	5	0,99
IPP4	162	1,78	1	5	1,10
IPP5	162	2,20	1	5	1,07
IPP6	162	2,49	1	5	1,02
IPP7	162	1,87	1	5	1,17
IPP8	162	1,80	1	5	1,07

Table 40 – IPP Distribution Stats.

## Appendix K – Distribution Statistics

Construct	Test Item Code	Valid N	Mean	Minimum	Maximum	Std.Dev.
Financial Resources	IPF1	162	3,50	1	5	1,02
	IPF2	162	3,49	1	5	1,02
	IPF3	162	2,75	1	5	0,84
Environment	IPF4	162	2,86	1	5	0,81
	IPF5	162	2,98	1	5	0,76
	IPF6	162	2,35	1	5	1,08
	IPF7	162	3,41	1	5	1,08
	IPF8	162	2,36	1	5	1,07

	IPF9	162	3,52	1	5	1,02
Organisational Management	IPF10	162	3,48	1	5	0,91
	IPF11	162	2,04	1	5	1,03
	IPF12	162	3,48	1	5	0,99
	IPF13	162	3,64	1	5	0,90
Technology	IPF14	162	3,91	1	5	1,05
	IPF15	162	2,58	1	5	0,98
	IPF16	162	4,16	1	5	0,99
Consumer Demands	IPF17	162	2,59	1	5	0,92
	IPF18	162	2,30	1	5	0,93
	IPF19	162	2,57	1	5	1,00
	IPF20	162	2,54	1	5	0,90
Market	IPF21	162	2,64	1	5	1,03
	IPF22	162	2,59	1	5	0,93
	IPF23	162	2,49	1	5	0,95
	IPF24	162	2,43	1	5	0,95
Networking & Collaboration	IPF25	162	2,48	1	5	0,97
	IPF26	162	2,51	1	5	0,96
	IPF27	162	2,35	1	5	0,97
	IPF28	162	2,36	1	5	0,88

*Table 41 - Innovation Performance Factors Distribution Stats*

## Appendix L – Factor Analysis IP

Variable	Factor Loadings IP (Varimax normalized)					
	Extraction: Principal components (Marked loadings are >,5000)					
	Factor (1)	Factor (2)	Factor (3)	Factor (4)	Factor (5)	Factor (6)
Lack of funds within your organisation	0,2031	0,2385	0,0989	<b>0,8713</b>	0,1249	-0,0171
Lack of finance from external sources	0,1207	0,3409	0,1528	<b>0,8248</b>	0,1283	0,0976
Costs of digital innovations	0,3755	0,0799	0,3361	0,2714	<b>0,6477</b>	-0,0793
Availability of digital innovation platform	0,2492	0,1716	0,4102	0,0669	<b>0,7491</b>	0,1886
Availability of digital innovation hubs	0,3059	0,2445	0,2962	0,1333	<b>0,6946</b>	0,1956
Protection of intellectual property rights	0,2871	0,0427	<b>0,7239</b>	-0,0476	0,3687	0,2054
Government policy and politics	0,2211	0,2180	0,2164	0,0165	0,1664	<b>0,7580</b>
Existence of supporting legal framework	0,3470	0,0923	<b>0,7985</b>	-0,0242	0,2205	0,1606
Availability of government incentives and support	0,1924	0,4227	0,0216	0,4956	0,0804	<b>0,5044</b>
Management strategy in business operations	0,1983	<b>0,7438</b>	0,0799	0,1404	0,2279	0,0001
Frequency of change in management	0,3296	-0,0147	<b>0,7238</b>	0,2455	0,1557	-0,0279
Management awareness and support	0,2515	<b>0,8311</b>	0,1766	0,1244	-0,0433	-0,1689
Management digital competencies	0,0418	<b>0,8581</b>	0,1255	0,0875	0,0357	0,1040
Availability of able technology infrastructure	0,2418	<b>0,7211</b>	-0,1000	0,1835	0,1540	0,2887
Dynamic nature of digital technologies	0,3276	0,2828	<b>0,6406</b>	0,1073	0,3284	0,0334
Level IT skills/expertise	-0,0181	<b>0,7451</b>	0,0312	0,1937	0,1070	0,2711
Uncertain demand for digital good/services	<b>0,5774</b>	0,3328	0,4148	0,0931	0,3531	0,1069
Consumer expectations are too high	<b>0,6125</b>	0,1266	<b>0,6478</b>	0,1148	0,0520	0,0784

Consumers prefer imported digital goods/services	0,7539	0,1489	0,2721	0,1906	0,1734	0,2285
Consumers prefer traditional goods/ services	0,7464	0,1788	0,1872	-0,1218	0,2564	-0,0760
Market dominated by established enterprises/imports	0,6929	0,2482	0,1416	0,1697	0,3359	0,1316
Market demand to justify the investment	0,7939	0,0804	0,0755	0,2001	0,3439	0,0497
Availability of suitable market strategy	0,8584	0,1277	0,2363	0,0509	0,1975	0,0539
Availability of similar goods/services	0,8111	0,1552	0,3556	0,0046	0,1198	0,0704
Opportunities for collaboration with other firms and suppliers of equipment, materials and components	0,7903	0,1025	0,2852	0,2421	-0,0286	0,2630
Opportunities for interaction with universities and research institutions	0,7379	0,1529	0,3791	0,1464	-0,1075	0,2725
Availability of professional and industry associations	0,6195	0,0418	0,6104	0,2243	0,1348	0,0521
Opportunities for interaction with customers or clients	0,7307	0,0242	0,4705	0,1756	0,2601	-0,0962
<b>Expl.Var</b>	7,4461	3,9662	4,3372	2,2754	2,5420	1,4436
<b>Prp.Totl</b>	0,2659	0,1416	0,1549	0,0813	0,0908	0,0516

Table 42 - Factor Loadings IPF

## Appendix M – Correlations Matrix IP

Variable	Correlations IP Test Items															
	Marked correlations are significant at $p < ,0500$ N=162 (Casewise deletion of missing data)															
	Means	Std.Dev.	IP	FR1	FR2	PNA1	PNA2	LE1	LE2	LE3	GP1	GP2	OD1	OD2	OD3	OD4
IP	2,0224	0,9063	1,0000	0,1765	0,1012	0,2908	0,2735	0,3165	0,2749	0,2932	0,1114	0,0057	0,0178	0,0591	-0,0715	-0,0255
FR1	3,5000	1,0169	0,1765	1,0000	0,8269	0,2449	0,3497	0,1975	0,2077	0,3128	0,2056	0,5017	0,3943	0,3656	0,3075	0,3925
FR2	3,4877	1,0230	0,1012	0,8269	1,0000	0,3238	0,3473	0,2283	0,2219	0,3804	0,2706	0,5766	0,3652	0,4186	0,4016	0,4527
PNA1	2,8580	0,8104	0,2908	0,2449	0,3238	1,0000	0,7825	0,6298	0,5953	0,6465	0,3924	0,3322	0,3697	0,2261	0,2767	0,3128
PNA2	2,9815	0,7598	0,2735	0,3497	0,3473	0,7825	1,0000	0,5667	0,5262	0,5923	0,4240	0,3986	0,4244	0,3520	0,3338	0,4337
LE1	2,3457	1,0824	0,3165	0,1975	0,2283	0,6298	0,5667	1,0000	0,8158	0,6084	0,4225	0,1841	0,2012	0,1690	0,1739	0,1704
LE2	2,3642	1,0734	0,2749	0,2077	0,2219	0,5953	0,5262	0,8158	1,0000	0,6802	0,3981	0,2279	0,2824	0,2618	0,1760	0,1623
LE3	2,5802	0,9763	0,2932	0,3128	0,3804	0,6465	0,5923	0,6084	0,6802	1,0000	0,3469	0,2859	0,4020	0,3662	0,3395	0,3192

GP1	3,4136	1,0843	0,1114	0,2056	0,2706	0,3924	0,4240	0,4225	0,3981	0,3469	1,0000	0,4274	0,2993	0,2251	0,3131	0,3774
GP2	3,5247	1,0166	0,0057	0,5017	0,5766	0,3322	0,3986	0,1841	0,2279	0,2859	0,4274	1,0000	0,5354	0,3847	0,4391	0,5402
OD1	3,4815	0,9138	0,0178	0,3943	0,3652	0,3697	0,4244	0,2012	0,2824	0,4020	0,2993	0,5354	1,0000	0,6581	0,5746	0,5644
OD2	3,4815	0,9858	0,0591	0,3656	0,4186	0,2261	0,3520	0,1690	0,2618	0,3662	0,2251	0,3847	0,6581	1,0000	0,7070	0,5892
OD3	3,6358	0,9038	-0,0715	0,3075	0,4016	0,2767	0,3338	0,1739	0,1760	0,3395	0,3131	0,4391	0,5746	0,7070	1,0000	0,6120
OD4	3,9074	1,0503	-0,0255	0,3925	0,4527	0,3128	0,4337	0,1704	0,1623	0,3192	0,3774	0,5402	0,5644	0,5892	0,6120	1,0000
OD5	4,1605	0,9901	-0,1226	0,3516	0,4803	0,2918	0,2434	0,1392	0,1492	0,2950	0,3370	0,4712	0,5044	0,4995	0,6349	0,6355
MEEC1	2,5864	0,9234	0,1920	0,3472	0,4055	0,6514	0,6087	0,6286	0,6542	0,6674	0,3890	0,4112	0,4877	0,4112	0,3840	0,3893
MEEC2	2,2963	0,9251	0,3134	0,3433	0,3386	0,5121	0,4762	0,6848	0,7288	0,6475	0,3972	0,2497	0,2784	0,3739	0,2190	0,2394
MEEC3	2,5741	0,9957	0,3229	0,3895	0,3698	0,5173	0,5068	0,5121	0,5703	0,6200	0,3770	0,4492	0,3633	0,2735	0,2683	0,3600
MEEC4	2,5370	0,8995	0,1528	0,1799	0,1861	0,4205	0,4418	0,5098	0,5102	0,5058	0,2676	0,1858	0,3333	0,3440	0,1351	0,2699
MEEC5	2,6358	1,0261	0,2568	0,3601	0,4247	0,5723	0,5729	0,4552	0,4482	0,5347	0,3874	0,3927	0,3538	0,4139	0,3517	0,3662
MEEC6	2,5864	0,9301	0,2523	0,4170	0,3112	0,5067	0,5604	0,4020	0,4442	0,4574	0,3616	0,3426	0,3453	0,3066	0,1448	0,3547
MEEC7	2,4938	0,9539	0,3284	0,3137	0,2800	0,5010	0,4926	0,5555	0,5512	0,5108	0,3538	0,2628	0,2956	0,3665	0,1955	0,3497
MEEC8	2,4259	0,9510	0,2753	0,2473	0,2449	0,4819	0,4666	0,5681	0,5955	0,5617	0,3582	0,3006	0,3343	0,3497	0,2322	0,3133
MEEC9	2,4815	0,9667	0,2517	0,3854	0,3704	0,3970	0,4604	0,4573	0,5243	0,5116	0,4014	0,4492	0,2914	0,3288	0,2304	0,3623
MEEC10	2,5123	0,9603	0,2695	0,3275	0,2942	0,3973	0,4387	0,4500	0,6072	0,5024	0,4096	0,3973	0,3046	0,3677	0,2306	0,3675
MEEC11	2,3519	0,9683	0,3396	0,3816	0,3901	0,5548	0,5408	0,6418	0,7126	0,6566	0,3456	0,2908	0,2426	0,3095	0,1970	0,2338
MEEC12	2,3642	0,8829	0,3390	0,4116	0,3179	0,5501	0,5471	0,5823	0,6521	0,6612	0,3218	0,1871	0,3048	0,2968	0,1517	0,1705
Variable	Means	Std.Dev.	OD5	MEEC1	MEEC2	MEEC3	MEEC4	MEEC5	MEEC6	MEEC7	MEEC8	MEEC9	MEEC10	MEEC11	MEEC12	
IP	2,0224	0,9063	-0,1226	0,1920	0,3134	0,3229	0,1528	0,2568	0,2523	0,3284	0,2753	0,2517	0,2695	0,3396	0,3390	
FR1	3,5000	1,0169	0,3516	0,3472	0,3433	0,3895	0,1799	0,3601	0,4170	0,3137	0,2473	0,3854	0,3275	0,3816	0,4116	
FR2	3,4877	1,0230	0,4803	0,4055	0,3386	0,3698	0,1861	0,4247	0,3112	0,2800	0,2449	0,3704	0,2942	0,3901	0,3179	
PNA1	2,8580	0,8104	0,2918	0,6514	0,5121	0,5173	0,4205	0,5723	0,5067	0,5010	0,4819	0,3970	0,3973	0,5548	0,5501	
PNA2	2,9815	0,7598	0,2434	0,6087	0,4762	0,5068	0,4418	0,5729	0,5604	0,4926	0,4666	0,4604	0,4387	0,5408	0,5471	
LE1	2,3457	1,0824	0,1392	0,6286	0,6848	0,5121	0,5098	0,4552	0,4020	0,5555	0,5681	0,4573	0,4500	0,6418	0,5823	
LE2	2,3642	1,0734	0,1492	0,6542	0,7288	0,5703	0,5102	0,4482	0,4442	0,5512	0,5955	0,5243	0,6072	0,7126	0,6521	
LE3	2,5802	0,9763	0,2950	0,6674	0,6475	0,6200	0,5058	0,5347	0,4574	0,5108	0,5617	0,5116	0,5024	0,6566	0,6612	
GP1	3,4136	1,0843	0,3370	0,3890	0,3972	0,3770	0,2676	0,3874	0,3616	0,3538	0,3582	0,4014	0,4096	0,3456	0,3218	
GP2	3,5247	1,0166	0,4712	0,4112	0,2497	0,4492	0,1858	0,3927	0,3426	0,2628	0,3006	0,4492	0,3973	0,2908	0,1871	
OD1	3,4815	0,9138	0,5044	0,4877	0,2784	0,3633	0,3333	0,3538	0,3453	0,2956	0,3343	0,2914	0,3046	0,2426	0,3048	
OD2	3,4815	0,9858	0,4995	0,4112	0,3739	0,2735	0,3440	0,4139	0,3066	0,3665	0,3497	0,3288	0,3677	0,3095	0,2968	
OD3	3,6358	0,9038	0,6349	0,3840	0,2190	0,2683	0,1351	0,3517	0,1448	0,1955	0,2322	0,2304	0,2306	0,1970	0,1517	
OD4	3,9074	1,0503	0,6355	0,3893	0,2394	0,3600	0,2699	0,3662	0,3547	0,3497	0,3133	0,3623	0,3675	0,2338	0,1705	
OD5	4,1605	0,9901	1,0000	0,3923	0,1715	0,2462	0,1258	0,3147	0,1400	0,1523	0,1644	0,1524	0,2004	0,0962	0,0677	
MEEC1	2,5864	0,9234	0,3923	1,0000	0,6897	0,7327	0,6280	0,6857	0,6385	0,7057	0,7181	0,6420	0,5906	0,7125	0,7268	

MEEC2	2,2963	0,9251	0,1715	0,6897	1,0000	0,7043	0,6062	0,6052	0,5764	0,6989	0,7523	0,6799	0,7580	0,7705	0,7872	
MEEC3	2,5741	0,9957	0,2462	0,7327	0,7043	1,0000	0,5968	0,7591	0,6604	0,7526	0,7635	0,7887	0,7428	0,6847	0,7286	
MEEC4	2,5370	0,8995	0,1258	0,6280	0,6062	0,5968	1,0000	0,5901	0,6680	0,7386	0,6893	0,5651	0,5495	0,5233	0,6594	
MEEC5	2,6358	1,0261	0,3147	0,6857	0,6052	0,7591	0,5901	1,0000	0,6807	0,7306	0,6755	0,6726	0,5877	0,5924	0,6684	
MEEC6	2,5864	0,9301	0,1400	0,6385	0,5764	0,6604	0,6680	0,6807	1,0000	0,7707	0,6989	0,6719	0,6281	0,6246	0,7745	
MEEC7	2,4938	0,9539	0,1523	0,7057	0,6989	0,7526	0,7386	0,7306	0,7707	1,0000	0,8143	0,7577	0,7392	0,7186	0,7586	
MEEC8	2,4259	0,9510	0,1644	0,7181	0,7523	0,7635	0,6893	0,6755	0,6989	0,8143	1,0000	0,7485	0,6981	0,8008	0,7979	
MEEC9	2,4815	0,9667	0,1524	0,6420	0,6799	0,7887	0,5651	0,6726	0,6719	0,7577	0,7485	1,0000	0,8500	0,7336	0,6811	
MEEC10	2,5123	0,9603	0,2004	0,5906	0,7580	0,7428	0,5495	0,5877	0,6281	0,7392	0,6981	0,8500	1,0000	0,6933	0,6576	
MEEC11	2,3519	0,9683	0,0962	0,7125	0,7705	0,6847	0,5233	0,5924	0,6246	0,7186	0,8008	0,7336	0,6933	1,0000	0,8445	
MEEC12	2,3642	0,8829	0,0677	0,7268	0,7872	0,7286	0,6594	0,6684	0,7745	0,7586	0,7979	0,6811	0,6576	0,8445	1,0000	

Table 43 - Correlations Matrix IP Test Items

## Appendix N – Spearman-R IP

Pair of Variables	Spearman Rank Order Correlations IP MD pairwise deleted Marked correlations are significant at $p < .0500$			
	Valid (N)	Spearman (R)	t(N-2)	p-value
IP & IP				
IP & FR	162	0,1991	2,5703	0,0111
IP & PNA	162	0,2833	3,7370	0,0003
IP & LE	162	0,2858	3,7719	0,0002
IP & GP	162	0,0699	0,8867	0,3766
IP & OD	162	0,0733	0,9303	0,3536
IP & MEEC	162	0,3125	4,1618	0,0001
FR & IP	162	0,1991	2,5703	0,0111
FR & PNA	162	0,3605	4,8886	0,0000
FR & LE	162	0,2966	3,9289	0,0001
FR & GP	162	0,4545	6,4546	0,0000
FR & OD	162	0,4688	6,7132	0,0000
FR & MEEC	162	0,3965	5,4626	0,0000
PNA & IP	162	0,2833	3,7370	0,0003
PNA & FR	162	0,3605	4,8886	0,0000
PNA & LE	162	0,6489	10,7889	0,0000
PNA & GP	162	0,4332	6,0803	0,0000
PNA & OD	162	0,3852	5,2791	0,0000
PNA & MEEC	162	0,6289	10,2313	0,0000
LE & IP	162	0,2858	3,7719	0,0002
LE & FR	162	0,2966	3,9289	0,0001
LE & PNA	162	0,6489	10,7889	0,0000
LE & GP	162	0,3647	4,9537	0,0000
LE & OD	162	0,2485	3,2450	0,0014
LE & MEEC	162	0,7116	12,8109	0,0000
GP & IP	162	0,0699	0,8867	0,3766
GP & FR	162	0,4545	6,4546	0,0000
GP & PNA	162	0,4332	6,0803	0,0000
GP & LE	162	0,3647	4,9537	0,0000
GP & OD	162	0,5294	7,8927	0,0000
GP & MEEC	162	0,3975	5,4802	0,0000
OD & IP	162	0,0733	0,9303	0,3536
OD & FR	162	0,4688	6,7132	0,0000
OD & PNA	162	0,3852	5,2791	0,0000
OD & LE	162	0,2485	3,2450	0,0014
OD & GP	162	0,5294	7,8927	0,0000
OD & MEEC	162	0,3112	4,1422	0,0001
MEEC & IP	162	0,3125	4,1618	0,0001
MEEC & FR	162	0,3965	5,4626	0,0000
MEEC & PNA	162	0,6289	10,2313	0,0000
MEEC & LE	162	0,7116	12,8109	0,0000
MEEC & GP	162	0,3975	5,4802	0,0000
MEEC & OD	162	0,3112	4,1422	0,0001

Table 44 - Spearman-R Correlations IP