

The influence of infrastructure flexibility on the relationship between innovative capability, human capital and growth: A study of high technology business in Gauteng

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ABSTRACT

The 'innovation imperative' - a salient demand on organisations to outclass their competitors in services rendered, products generated, as well as the channels of delivery - or face elimination, is a motivator behind the level of competitiveness in today's global economy. As a result, innovation and the advent of technology has been a central and wide-ranging theme in academic research. In the recent past, business growth has been attributed to the mere development of Information Technology (IT) infrastructure. Contrary to that notion though, more and more authors are referring to the *flexibility* of IT infrastructure as a cornerstone for optimal business operations and a response mechanism to changing organizational needs (MacKinnon, Grant, & Cray, 2008). Given the failure of the formal and public sector to absorb the growing number of job seekers in South Africa, increasing attention has focused on growth enterprises and their potential for contributing to economic growth, job creation and innovation (Herrington *et al.*, 2009). The researcher sampled firms occupying the high technology spaces within Johannesburg as Information Communication Technology (ICTs) have permeated every facet of the contemporary organisations' value chain, thus generating an automated grid of interrelated applications and information for business processes (Kohli & Melville, 2009). The study found that operational firm performance would improve if organisations were to make investments in IT infrastructure flexibility and exploit the human capital and innovative capability at their disposal.

DECLARATION

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

Signed at Johannesburg.....on the 28th day of April 2017

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1 CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Companies apply various technologies to their products, production and processes in order to attain and sustain competitive advantage. In an increasingly uncertain business world, change and innovation are central to stimulating industries for economic growth, competition and sustainability (Hung & Chu, 2006). A firm's ability to recognise novel, external information, further apply, and assimilate this for commercial gain is a distinct advantage. While that is true, Byrd and Turner (2000) suggested that Information Technology (IT) infrastructure flexibility is the new weapon to achieve a competitive advantage and growth. In pursuit of the growth in high technology firms in Gauteng, IT infrastructure flexibility is a construct worth further investigation, especially when coupled with innovative capability and human capital.

1.2 PURPOSE OF THE STUDY

The purpose of the study is to examine empirically the relationship between the influence of Information Technology infrastructure flexibility (ITIF), innovative capability, and human capital as well as how the growth of high technology firms is affected. The focus on flexibility in IT infrastructure is important because it allows robustness in enabling change and responsiveness to the needs of globalised businesses. It becomes particularly important in high technology firms that can leverage this against innovative capability and human capital.

1.3 CONTEXT OF THE STUDY

The year 2015 challenged the economic performance of the South African economy and the Gross Domestic Product (GDP) declined because of low consumer and business confidence. It has also been reported that Sub-Saharan African GDP grew steadily at a higher rate than the continental average, excluding South Africa (African Economic Outlook South Africa 2016). The urgent need for productive entrepreneurial behaviour is

under the spotlight, as economic growth, job creation, the re-direction of national infrastructure and innovation is the benefit of entrepreneurial activity. Furthermore, with the exception of Morocco, South Africa is the only efficiency driven economy in Africa. (Global Entrepreneurship Monitor report 2016). Such an economy is characterised by a competitive economy that is reliant on industrialisation, economies of scale and a capital-intensive industry. The introduction of novel innovative products and the enhancement of technology for growth firms are worth further investigation. This research focuses on the growth of big business in the high technology sector. This is a deviation from the start-ups, where most policymakers have focused their interventions (Mason & Brown, 2013), yet recent literature pointed to big business because of its greater pool of resources to reach economies of scale.

1.4 MAIN PROBLEM

The technology industry and organisations utilizing technology for growth, is one of the most dynamic industries in the world economy, thus it is fitting to conduct a study on firm growth in high technology businesses. The innovation and technology industry is a constantly changing environment and the technology revolution will create new prospects in the forms of unsatisfied demands (Griffith and Rubera, 2014). Wu, Liang, Yu and Ying Yang (2010) acknowledged the overwhelming support of the discourse on high technology progress and it demonstrated a solid correlation between free enterprise and innovation, which is predominant in several nations. However, despite such strides, there are still many untapped potential markets and value-added options for growth in the high technology industry, especially where end users and clients are cradles of innovation (Connell & Probert, 2010). One such field is IT infrastructure flexibility and innovative capabilities. Africa has constraints and special challenges when it comes to technological advances compared to Europe and the United States, especially in terms of its human capital resources and capabilities (Chen & Yuan 2007; Lee, Lee & Pennings 2001).

1.4.1 Sub-problems

- Evaluating innovative capability as a viable growth factor in Gauteng high technology firms

- Defining the impact of human capital (entrepreneurial competency and entrepreneurial experience) on the propensity for rapid growth in high technology firms
- Appraising local readiness in relation to IT infrastructure flexibility to support growth technology firms

1.4.2 Significance of the study

This study offers insights to organisations and management of high technology-based firms specifically on how to shape their businesses to realise growth. By examining the relationship between the influence of infrastructure flexibility, innovative capability and human capital, this study suggests actions required to prioritise growth. The study provides guidance to policy makers on creating an enabling environment for growth enterprises to thrive. It also sheds light on the intricacies of the South African technology landscape for potential entrepreneurs in terms of complexities and opportunities identified in the market. The emphasis on support for technological development reflects the strong cross-over between entrepreneurship and innovation philosophy that is prevalent across many nations (Audretsch 2007). This study also aids entrepreneurs who have a strong aptitude for internationalization by understanding new spaces to set up supplementary resources to accomplish the aspirations of their organizations in meeting their international clients' expectation (Davenport, 2009).

1.5 DELIMITATIONS OF THE STUDY

- The study includes all employees in high technology sectors
- The focus is on high technology firms that have been in operation in South Africa for a minimum of three years, specifically those based in Gauteng.

1.6 DEFINITION OF TERMS

- High technology- is regarded as: a) rapid renewal of cutting edge information compared to other technological expertise, and b) a level of intricacy that

demands arduous hours of incessant investigations and a comprehensive scientific foundation (Spanish National Institute of Statistics INE (2013))

- Innovative capability - a term that broadly refers to a firm's ability relative to that of its competitors to apply the collection of skillset, resources and knowledge to innovation related to new products, processes, services and management, marketing or work organisation systems, in a bid to create added value for the organisation and its stakeholders (Hogan *et al.* 2011)
- Process Innovation - refers to a firm's assumption of novel or considerably enhanced production procedures in terms of apparatuses used or production organisation or both. The intention may be the achievement of unique production approaches that may be difficult to attain using orthodox plants or production methods, or fundamentally to intensify the production efficacy of existing products (Reguia, 2014)
- Product innovation – refers to the improvement of new products by implementing modifications in the existing product design or the utilisation of innovative practices in the existing production methods, in order to focus on existing markets for existing products. In this way, a product is easily distinguishable through features and functions that available (Reguia, 2014).
- Information Technology Infrastructure flexibility ITIF– is the capability to effortlessly and readily diffuse support to a wide range of hardware, software, communications technologies, data, core applications, skills, competencies, commitments within the technical physical and human interface (Byrd, 2000).
- Entrepreneurship - an activity that is concerned with the unearthing, appraisal and taking advantage of gaps in the market by the provision of new goods and services, new ways of organising, processes, markets and raw materials that did not exist previously (Shane & Venkataraman 2000).
- High-growth –In this study, a high-growth firm is defined as 'enterprises with average annualised growth in turnover greater than 20% per annum, over a three-year period and with more than 10 employees in the beginning of the observation period' (OECD 2007:p16).
- Growth is a multi-faceted phenomenon that is commonly associated with firm survival, achievement of business goals and success, or scaling up activities (Hynes 2010)

1.7 ASSUMPTIONS

Leedy and Ormrod (2010) declared that assumptions were so basic, that if not present, the research problem itself could not exist. Therefore, the researcher acknowledged several assumptions to give existence to the research problem. The study assumed that:

- It is expected that all employees involved in high technology who are comfortable with participation and consented in writing, were considered as participants
- This researcher assumed that respondents were well versed with the complexities and issues inherent in the high technology space and therefore understand its relation to growth

1.8 OUTLINE OF SUBSEQUENT CHAPTERS

Chapter 2 focused on a rich literature review about IT infrastructural flexibility and other associated constructs in the field, such as innovative capabilities and creative accumulation in the high technology sector space. In the entrepreneurial field, it is pivotal to explore matters relating to entrepreneurial competence versus the argument on entrepreneurial experience. Ensuing from these arguments, chapter 3 delved on the investigator's paradigm approach on the study, the research design and subsequent limitations that constrained this work. Chapter 4 is a comprehensive presentation of the research results and Chapter 5 focused on the discussion of results respectively; sound, empirically founded opinions were suggested where the hypotheses or propositions are accepted or rejected. Chapter 6 is devoted to the summary of literature and all pertinent arguments, the consequences of study findings, suggested future research and necessary recommendations.

1.9 CONCLUSION

The influence of Information and Communication Technology (ICT) on efficiency has been a subject of interest for a while in trade and industry research. Thus far, the ICT infrastructure flexibility and growth enigma has been mainly approached using the sales and turnover context and thus most linkages have been indicative as opposed to conclusive in nature. Shahiduzzaman *et al.* (2015) noted that several cycles of

corresponding novelty and financial outlay stalled as a direct result of the technological capabilities in ICT. The authors suggested that greater investments in longitudinal data that would encompass spanning successions of commercial action may bear better prospects for unearthing a clearer association between ICT, efficiency and growth in the high technology sector, especially in nations that have been categorised as efficiency driven.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

Policymakers, technology entrepreneurs or ‘technopreneurs’ and academics have considered the formulation of high capability firms in high technology industries as a panacea for economic growth (Millman, Li and Chi, 2012). The production or efficacy of high technology industries demands a high value proposition, preparation and capability assessment (Villamizar, Cobo and Rocha, 2017). The literature section reviews how the human capital theory and innovative capability as independent variables contribute to growth in high technology enterprises. The development and management of innovation has faced several challenges and innovation literature has identified flexibility as the missing piece of the puzzle. The literature on infrastructure flexibility as a mediating variable embeds flexibility as a fundamental growth reinforcement for high technology firms in Gauteng. It further demonstrates that infrastructure flexibility is a foundation for seamless business applications, which is critical for high impact businesses operating in a globalised world. This construct adversely affects the relationship between innovative capability and human capital, in that, it attracts persons with superior human capital to such firms and encourages firms to pool their resources and capabilities to respond quickly to strategic moves by competitors.

2.2 HIGH TECHNOLOGY INDUSTRY

According to Villamizar, Cobo and Rocha, (2017) technology is broadly believed to be the collection of information that is essential to produce novel products and services. High technology is regarded as: a) rapid renewal of cutting edge information compared to other technological expertise, and b) a level of intricacy that demands arduous hours of incessant investigations and a comprehensive scientific foundation. Schaffer, Chastagner and Umesh (2016) said high technology is considered to be a rapid, short product-life-cycle setting where any latent technical incompetence or inadequacy have a detrimental effect on performance of that resource. Since high technology embodies the innovative presentation of scientific knowledge in the advancement of products and

services, it is at the frontline of the conception of prospects for unparalleled realization of consumer needs (Griffith and Rubera, 2014). It is noteworthy to emphasise that the descriptions of high technology are commonly realised by a far-reaching list of eligibility in terms of products and sector approach. It holds therefore that uncertainty may be experienced as the thresholds for the demarcation of sectors can be haphazard. Preliminary literature regarding the high technology sector made reference to distinct groupings (Hatzichronoglou, 1997) with the intention of evaluating the influence of technology intensity on industrial performance. In keeping with the same theme, Kohers and Kohers (2000) released a list of sectors to be considered as part of the high technology sector; these include but not limited to, biotechnology and health, communications, computers hardware and software, microelectronics to name a few. Robertson, Smith, & von Tunzelmann (2009) noted that the categorization of absolute industries based on their technological concentration brought about a number of challenges:

- Firstly there is difficulty in creating a fixed criteria to classify the technological measure of an industry, taking into account the dynamic nature of technology
- Secondly, the challenge of setting the concept of what a high technology industry is to be perceived as: is it one that produces technology or one utilising technology in a rigorous manner?
- Thirdly, there often is some amount of uncertainty in deciding the cut-off points among the levels of technology.

2.2.1 High technology and the role of Government

In the context of South Africa, the government has been a robust role player in creating initiatives and value chains in the high technology sector but for the purpose of this study we won't look testing government. Woolley (2017) said government research and test centres had relatively little representation in the entrepreneurship literature, regardless of the frequency of such action. In most cases, state funded R&D often emphasises on precise requests of rudimentary science work, typically grounded on a proof of concept, to justify government backing. Hruby, Manley, Stoltz, Webb, & Woodard, (2011)

emphasised that government laboratories conducted high technology research to resolve existing difficulties encountered by the government that may not have instantaneous enterprise opportunities.

For instance, the Department of Science and Technology (2013) in the Bio-Economic Strategy, presented its case as a key entity in developing a sustainable, knowledge-driven, high technology sector that is capable of novelty and commercialisation. Below, the South African government has identified niche areas where other government line departments, will increase collaborations within the national system of innovation.

	Drive innovation	Priority setting	Human capital development	Implementation of innovative strategies	Funding
Science and Technology	✓		✓	✓	✓
Health	✓	✓	✓	✓	✓
Trade and Industry	✓	✓		✓	✓
Agriculture, Forestry and Fisheries	✓	✓	✓	✓	✓
Environmental Affairs	✓	✓		✓	✓
Higher Education and Training			✓		✓
Economic Development	✓	✓		✓	✓
Energy	✓	✓		✓	✓
Mineral Resources	✓			✓	✓
Rural Development and Land Reform	✓	✓	✓	✓	✓
Water Affairs	✓	✓		✓	✓
Social Development	✓	✓	✓	✓	✓
Human Settlements	✓	✓		✓	✓
Traditional Affairs	✓	✓		✓	
National Treasury	✓	✓			✓

Figure 1: Proposed roles of other SA government departments (Source: BioEconomic Strategy)

Berry and Grayeff (2009) lauded the Israeli government for its international prowess in its involvement as a player the high technology sector. This was achieved by the government's commitment to supporting a civilian research and development as the propeller of economic transformation, and then effecting policies to create it and ensure its expansion.

Government labs are involved in high technology through the rapid renewal of cutting edge innovation and access to levels of scientific complexities that demands arduous hours of incessant investigations. Government as a central administrative body, will have cross sectional access to all high technology industries, with regard to work done in

laboratories or test centres. The researcher holds the belief that IT infrastructure flexibility provides a meeting point for the two dimensions, that are critical to government – transparency and interactivity Demchak et al., (2000). Such scope reflects the organisation's level of directness (which (that is, the level to which a government offers comprehensive information and maintains timely communication with all key public audiences. As such, governmental openness can be assumed to be a measure of government responsiveness to citizens' demands for information and services from government organisations and also as a measure of government accountability.

Pina, Torres and Royo (2009) cited the implementation of web-based expertise to provide superior public administration to the masses as on an upward trend. From a strategic point of view, IT infrastructure flexibility may support the performance of government in high technology. E-Governance is the digital communication among government, parliament, central and local governments and citizens. By implementing e-government, the (central and/or local) government has to remodifies the way in which the state interacts with the public, bringing it closer to the citizen and it involving him in the government process. According to Clift (2003) e-government initiatives strive to enhance government responsibility and transparency, relating to parties with vested interest and cooperating with the public will in these contemporary times. E governance is active on the following levels:

- The interaction between Government and Citizens (G2C): The Government must implement information technologies in order to facilitate the simple transaction of the civilians' responsibilities towards the state (taxes, fees, etc.)
- Interaction between Government and Government agencies (G2G): The second level addresses communication between state institutions. By implementing intelligent solutions, the interaction will become more efficient using Intranet, which will allow better collaboration and more efficient resource assignment.
- Interaction between Government and the Business environment (G2B): These are e-services devoted to industry, such as: the procedure to register a business, to obtain documents, certificates, licenses. These services, which traditionally require bureaucratic procedures and long waiting, shall be more accessible.

2.2.2 High technology and Internationalization

Internationalization has become a very good indicator of long-term competitiveness of an enterprise. Johanson & Vahlne, (2009) proposed internationalization can be defined as a learning process and represents the notion of accelerated development, in relation to a process by which a firm expands its business outside its borders. Internationalization is dependent on co-operation and networking processes (Casillas et al., 2014). Research has proven that connectedness, which is the strength of relationships (foreign partners, customers, and suppliers) is critical in internationalization (Johanson & Vahlne, 2009; Chetty & Stangl, 2010).

The phenomenon of open innovation is supported by rising globalization capacities in R&D, expertise and equipment, as well as innovations, which are stimulated by new information, communication technologies, new forms of organizations and business models (Lichtenthaler, 2011). Chesbrough et al., (2006) defined the open innovation strategy as the utility of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively. Open innovation strategy encourages the flow of knowledge in process or product innovation or any service that may be offered. And since Bhatt (2010) described flexibility as the ability to rapidly disseminate information and respond to environmental change, internationalization will be realised through IT flexibility to support high technology in firms. In this way, firms' would gain access to knowledge networks, which can consist of global partners. Such international relations can help knowledge-intensive firms to more rapidly adjust their internal structures in pursuing to conquer foreign markets (Ejler et al., 2012), develop capital of international relations as well as to easier and faster estimate the latency of entrepreneurial prospects provided by the international market.

2.3 INNOVATIVE CAPABILITY

The Global Entrepreneurship Monitor (GEM 2016) has classified South Africa and Morocco as the only efficiency driven economies in Africa. The suggestion is therefore that the growth of the South African economy is reliant on industrialisation, economies of scale and a capital-intensive industry. The argument warrants a discussion on innovative

capability as a conduit for novel innovative products and the enhancement of technology for growth firms

Most governments have increased their attempts to attract Foreign Direct Investment (FDIs) using incentives such as tax rebates and employment subsidies, among others, to bolster the local economy, either directly by creating employment or indirectly through technology, innovation as well as productivity spill-overs to local firms (Klepper, 2011). Knockaert, Ucbasaran, Wright and Clarysse (2011) suggested that technology productivity spill-overs are one of the most neglected, yet viable, benefits of FDI, especially in developing countries which often have inferior local technological systems than those employed by Multi-National Corporations (Kokko & Kravtsova, 2008). Dunning and Lundan (2007) noted that when foreign MNCs set up a subsidiary, their human capital and innovative capability is one of the firm-specific intangible assets that presents a competitive advantage over local firms that have superior knowledge of the local market and business environment.

Innovative capability is the ability to create new and valuable knowledge and products (Hagedoorn & Cloudt, 2003) and it is often the differentiating factor for new competitive start-ups (Lee *et al.*, 2001). Audretsch (2007) contributed by saying innovation capabilities were broadly encompassing in the following definitions:

(1) the capacity for unique product development by satisfying market needs; (2) appropriate application of process technologies for production; (3) the capacity of developing and adopting new product and processing technologies to satisfy the future needs; and (4) the agility to respond to accidental and unanticipated opportunities created by competitors.

Wang and Ahmed (2004) suggested that innovation capability is a firm's ability to bring new products to the market, or to create a novel market, while using strategic orientation as well as pioneering behaviour and processes. Innovation capability is an important competitive weapon for firms operating in dynamic situations (Parida *et al.*, 2012; Van de Vrande *et al.*, 2009). Therefore, Teece *et al.* (1997) offered that organisations with innovation capability were better poised to compete effectively and even withstand trying situations. Kogut and Zander (1992) figured innovative capability was the employees' ability to harness their knowledge and create new knowledge that would lead to process

or product innovation. Romjin and Albaladejo (2002) related innovative capability as organizational competencies to enhance products and processes. Szeto (2002) pronounced that high innovative capability was indicative of a firm that was responsive to changes in its operating environment such that it altered its production and process innovation and such dynamism is dependent on the available resources and idiosyncrasies of the organisation (Neely *et al*, 2001). Zhao *et al*. (2005) postulated that innovation capability was the culmination of the implementation of creativity within the organisation, and the presentation of competencies in order to gain market value for the firm.

2.3.1 Research and Development and Firm Performance

According to Tong (2005), various industries unevenly distributed technological opportunities, and thus Research and Development (R&D) often became a focal point of opportunities that are unevenly distributed. R & D has been used as a platform to set the stage for absorptive capacity, which is defined as structural procedures and practices whereby companies obtain, integrate, alter, and exploit expertise to create a vibrant organizational competence (Zahra & George, 2002).

Del Monte and Papagni (2003) acknowledged a positive relationship between Research and Development (R&D) and growth and performance of firms. The author added that the larger the expenditure budget for R&D, the more effective the novelty of the productive process and the less significant the creation costs sustained by firms. According to Coad and Rao (2008), the association between the novelty in the firm and the performance of a company seems to be a conundrum. On one hand, a handful of authors have attested firm growth to the strength of delivery of the R&D department, others reported that product innovation was among the most common development tactics favoured by firms (Carden, 2005). However, on the other hand, experimental work has not conclusively unearthed a solid relation concerning novelty and sales growth, and as such, the results have often been unassertive and unsatisfactory. Another obstacle in confirming the influence of novel inventions on growth is that there may be a long spell of non-activity before a discovery transforms into an idea of economic value. Bloom and Visintin and Pittino (2014) alluded to the fact that firm executives may delay the invention's discovery into a profit-making venture. Further criticism of R&D and firm

growth is that previous empirical work was combined with all types of industrial sectors, despite that innovation systems differ significantly across different fields. Coad and Rao (2006b) claimed that by considering market value as an alternative to firm performance weakened the argument supporting R&D and the firm growth discussion. As a result, the company may invest heavily in R&D and still not discover anything new; and may suffer losses at the expense of a competitor, who may successfully take over the market.

García-Manjón and Romero-Merino (2012) added that a firm's propensity for growth differs contingent on the industry, nation and the amount of time the company has been active in the market. There are a few results from a multi-sector or multi-territorial point of view, which correlate R&D and firm growth positively though, especially in high technology industries. Considering the superior knowledge-intensity advanced in these sectors when evaluated with non-technological or traditional sectors, it is sensible to anticipate strength in interrelations (knowledge creation) and firm growth. In keeping with this assertion, there has been optimistic market response to increased R&D investment for high technology industry businesses, while the link turns out to be undesirable for low-technology industry firms (Yu *et al.*, 2010). Coad and Rao (2008) added that the outcomes of the influence of innovation and on firm growth in high technology were inconsistent within the different sectors analysed, but it was generally recognized that a positive relationship subsists.

2.3.2 Relationship between Innovative capability and growth in high technology businesses

Literature has proven that the potential for growth and long-term sustainability of high technology start-up firms is attributable to innovative capability (Zheng *et al.*, 2010). A study by Lee *et al.* (2001) attributed the sales growth of 137 data technology firms to innovative capability. Similar studies have concluded that there was a positive correlation between an organisation's innovative capability and firm performance and growth (Shan, 1994; George *et al.*, 2002). Guan and Ma (2003) directly linked growth in terms of the export performance of firms to several dimensions of innovative capabilities such as learning, strategic as well as research and development capabilities. DeCarolis and Deeds (1999) also empirically proved that firms with proven innovative capability enjoyed

higher valuations for growth prospects by investors, because of the perceived potential to produce commercially superior and successful products.

2.3.3 Components of Innovative Capability: Product & Process Innovation

The prevailing description of innovation capability compels the reader to view it as an enabler of the entrenchment of organizational culture, an innate understanding of the dynamics and intricacies of the external environment to which employees need to respond. As a result, innovative capability is necessary for sustainable competitive advantage.

Although several definitions exist, for the purposes of this research, the definition advanced by Lee and Hsieh (2010) is the one to be utilised. The duo categorised innovative capability in the following dimensions; process, product, market and managerial innovation. For the purposes of this research, the researcher measured the first two dimensions only (product and process innovation).

Pisano (1997) noted that with the exception of work on manufacturing design practices, there were few discussions on the prowess of process innovation to enhance competitiveness capabilities. The author argued that the development of low to high technology industries is dependent on the effective execution of unique processes expertise. The speed and efficiency with which process innovations may be mastered at intra-firm level outlines the total cost incurred, relevance and results of novel market introductions.

Huergo and Juamandreu (2004) empirically tested process innovation and growth and determined that process innovation over time led to growth, while Thornhill (2006) noted that process innovation encourages industry dynamism, innovative firms are likely to enjoy revenue growth, irrespective of the industry in which they operate. Cohen and Klepper (1996) said when a firm develops a process innovation which lowers its average cost, the price of its product will remain constant and the firm will increase its profits by the decrease in average cost times its ex ante level of output. Innovations often covertly link to product innovation, yet recently process innovation has affected the proliferation of revolutionary lifestyle goods and services (Hori, *et al.*, 2015). 'Creative destruction' is a

term coined by J.A. Schumpeter, which defines vigorous uncertainty, thus essentially destroying old thought process in favour of more novel and competitively inclined ones (Peretto, 2015; Steinmeitz, 2015). Process innovation seems to favour the principles of creative destruction. For instance, the deliberate development of the mobile information and telecommunications industries is a classic example. Machikita and Ueki (2015) contended process innovation is a driver of superior product innovation; as such, creations demanded refined process control expertise. In fact, process innovation and development is the unseen advantage for business success and knowledge integration.

H1a: Process innovation is positively correlated to growth in high technology firm

Chen *et al.* (2015) offered that production innovation is one of the most important organizational attributes of firms in the 21st century, where business is global and characterised by shortened product lifecycles and where technology may be rendered obsolete, if not redundant, rapidly. Advanced product innovation has fast become the lifeblood of organisations because it is the foremost way to survive, compete and lead in intensely competitive environments. A classic example is that of Procter & Gamble (P&G), one of the leading consumer product companies worldwide, whose task is to serve the consumer needs of its varied population expediently and cost effectively. Hortinha, Carmen and Lages (2011) pointed out how the company prided itself on its ability to deliver a high frequency of products across several markets, and considered it as a sign of competitive prowess. Slater, Mohr and Sengupta (2014) described product innovation as the primary means of corporate renewal and that as an 'engine of renewal', it encourages growth and sustainability. Singh and Fleming (2010) argued that product innovation is a vibrant capability of the organisation, because of its ability to modify the resource configuration of the firm. The authors added that such innovation requires the firm to have competences in terms of technological prowess and customer relations and each of these competences represented a set of growth-inducing resources.

Whilst most developing nations cannot afford the fiscal and human resources bill to conduct R&D, product innovation is an avenue for firms to move up the technical ranking (Machikita & Ueki, 2015). Slater *et al.* (2014) noted that product innovation is critical to business revitalisation and success. In comparison to other types of innovation, product

innovations offer the platform to produce new industries, any of which should lead to greater organizational performance and meet the ever-evolving needs of customers.

H1b: Product innovation is positively correlated to growth in high technology firm

2.4 HUMAN CAPITAL

Human capital has been one of the most researched concepts and many authors have described it differently. Successful entrepreneurial firms have extensively credited their economic prowess to attributes of human capital (Florin, *et al.*, 2005; Unger, *et al.*, 2009).

2.4.1 Definition and concepts of human capital

Human capital is the intelligence, natural skills and abilities refined by formal education and job experience. Defined from an individualistic perspective, human capital is a cocktail of inherited heritage, learning and knowledge as well as one's approach to life and commerce. The essence of human capital is the manifestation of how employees enact their intelligence, how they combine, mobilise and reconfigure resources at their disposal to add value (Martin *et al.*, 2013). Human capital can be traditionally described as a combination of competencies such as education, training, prior knowledge and industry experience (Barreira *et al.*, 2010). Wang *et al.* (2008) considered human capital in the following categories of competences (knowledge and skills), attitudes (motivations and behaviour) and intellectual agility (innovation, simulation, adaptation and packaging). Chen and Li (2003) defined it as exclusive, idiosyncratic firm investments in terms of talent and technologies for competitive advantage. The development of current knowledge created new knowledge within firms. It should follow therefore that a high level of specialised human capital is necessary for successful firms.

Speaking from a Resource Based Theory (RBT) perspective, Nyberg (2014) noted that in other instances, firms gained a competitive prowess and secured firm performance from accumulated human capital. The RBT promoted the development of idiosyncrasies unique to the firm, by suggesting alternatives in the combination of resources to consolidate their position in the market. Hitt (2016) described RBT as an organisation's

unique collection of varied resources from the competitor organisations that could create value by introducing a competitive advantage.

While organisations may employ various strategies, human capital is imperative, because it is the catalyst responsible for opportunity recognition (Urban, 2011). Venter, Urban, and Rwigema (2008) said the human capital theory provided individuals with increases in their cognitive abilities, leading to more productive and efficient activity. Once engaged, such individuals should also have superior ability in successfully exploiting opportunities. Cassar (2006) added that the human capital theory influenced entrepreneurial success because entrepreneurs who had made high investments in their human capital, looked for growth as well as profit in their firms in order to compensate for their investment in human capital. Further literature in entrepreneurship studies reinforced the argument that human capital led to entrepreneurial success. For example, an owner's human capital may increase their capability to recognise entrepreneurial opportunity (Shane & Venkataraman, 2000) and furthermore, human capital influences the approach to the exploitation of the opportunity (Shane, 2000). Human capital attracts strategic planning and venture creation, which ultimately leads to the success of the enterprise.

According to Unger *et al.* (2011), a company is an active incubator for knowledge and an information depository for configuration and where different staff competencies add value to the business. As an example, the tacit knowledge of employees contributes to the organizational culture, specifically the arrangement and harnessing of competencies into explicit knowledge within the organisation (Unger *et al.*, 2011). For the purposes of this study, the researcher has highlighted entrepreneurial experience and entrepreneurial competency of employees within high technology companies as attributes of human capital and a source of firm performance.

2.4.2 Human capital and Innovative capability

Vinding (2006) supposed human capital has an intimate relationship with innovative ability, whereby an organisation's ability in approaching and unearthing new influences in new knowledge is seen as displayed. He further added that the relationship further manifested through absorptive capacity. He argued that such capacity developed

through the accumulation of experience and this kind of firm-specific knowledge, may be measured by the work experience of the employees. The development of absorptive capacity occurred through the accumulation of experience and firm-specific knowledge, that is, knowledge established through learning and doing, may be measured by the work experience of the employees. To that end, Wahn *et al.* (2008) said the level and specificity of knowledge retained within an individual could either enable or frustrate the knowledge that could be absorbed, understood, and integrated.

2.4.3 The Relationship between Human Capital and Growth

Human capital also plays a major role in productivity growth. Among high technology manufacturers, developing new innovative products through Research and Development (R&D) and technical acumen, had the greatest impact on revenue growth when knowledge assets were high. Audretsch (1995) affirmed New Technology Based Firms (NTBFs) as fundamental economic stimulants. In fact, he reported that growth in such establishments was a clear sign that the public is receptive to these company products or services. This is consistent with the resource-based view that knowledge is a competitive resource within the company (Thornhill, 2006). To illustrate this point, he argued that in high technology industries where the pace of technical revolution is high, novel products had to overcome substantial technological challenges to distinguish themselves from the offerings of competing firms. In such circumstances, the human capital within an organisation proved to be invaluable. Worth noting is that other authors have conceded that growth is a challenge for NTBFs as most remain small businesses even years after operations began and to this end, previous studies published by Fischer and Reuber (2003) and that of Barringer *et al.* (2005) have been taken into account. Grant (1996) articulated the direct influence of human capital on growth, as it led to competence-based firms that possessed difficult-to-imitate capabilities and consequently, a competitive advantage. As a result, he explained growth differentials between NTBFs to be due to their idiosyncratic proficiencies (or the lack thereof in other cases). The human capital prowess of the NTBF founders, including their knowledge and skills is responsible for the distinctive capabilities of these firms (Colombo & Grilli, 2005a).

Internal stocks of capabilities are the collection of individual knowledge and competencies at one point in time—firms' intellectual capital or organizational memory (Zahra & George, 2002). Firms' competitive capabilities often stem from unique combinations of newly acquired knowledge with existing knowledge (Afuah, 2002). Exposure to new concepts and knowledge broadens understanding, sharpens problem-solving skills, and facilitates learning (Zahra & George, 2002). This helps firms develop valuable, unique capabilities (Winter, 1987), which create the foundation for attaining competitive advantage and growth. The strategic human capital is responsible for the improvement and efficiency of the firm and exploits market opportunities.

2.4.4 Entrepreneurial Competency

Fleury and Fleury (2001) defined competency as a predictable experience on how to perform; which suggests marshalling, incorporating, transmitting information, talents and resources, which strengthen financial worth to the organization and shared value to the entrepreneur. Entrepreneurial Competencies (ECs) are categorised as a precise cluster of proficiencies (Colombo & Grilli, 2005) that are essential to be executed for prosperous free enterprise. Businesspersons with established business competencies are more likely to introduce innovation to their businesses (Mitchelmore & Rowley, 2010).

Tartar (2014) described entrepreneurial competencies as a fundamental ingredient to create a merger between growing business needs as well as the improvement of managerial capacity, or commercial sustainability. Choe *et al.* (2013) said they could be measured as higher-level attributes, demonstrating the capability of the entrepreneur to perform the duties of the role effectively. Moreover, proficiencies are variable and can be learned, therefore tolerating mediation in terms of teaching free enterprise. Many a time, entrepreneurial competences are the reason for thriving small businesses (Mitchelmore & Rowley, 2013).

Although authors have acknowledged the role of entrepreneurial competencies and the performance of the firm and its expansion, the discussion is still in its early stages (Brinckmann, 2008). Man (2001) and Ahmad (2007) described entrepreneurial competency as a combination of prospects, business approach, ideas and models for business, as well as procedural proficiency in business processes. Man *et al.* (2002)

suggested that business people who became proficient in these matters had a constructive bearing on the company's strategic direction, and experiences, which include superiority in product and service provision, competitiveness and flexibility of organizational systems to realise promptness and sensitivity in the production processes. Man *et al.* (2002) noted that paradoxically, businesspersons could not be labelled with certainty as capable only due to their possession of some abilities; however, these attributes had to be verified through the individual's actions and behaviours.

Recent study by Wickramaratne, Kiminami, and Yagi, (2014) established that entrepreneurial competencies had an indirect effect on how a business accomplished its intentions by positively affecting a firm's owner or manager's aptitude to scout for new prospects and reinforce organizational strategy.

H2a: Entrepreneurial competency is positively correlated to growth in high technology firm

2.4.5 Entrepreneurial Experience

According to Odorici and Persutti (2013), entrepreneurial experience is previous exposure to commercial proprietorship. Politis (2008) said individuals who were experienced in business offered tangible understanding of evolving organisations, harnessing resources and skills, labour, and are familiar with the exploitation of established and active social linkages. Ucbasaran, *et al.* (2010) believed entrepreneurial experience is a useful concept for study in its effect on strategic orientation of customary and amateur entrepreneurs in Born Global start-up businesses. For instance, compared to beginners in the entrepreneurship field, habitual entrepreneurs did not solely depend on their ability to be innovative or techno-savvy to furnish clients with critical value add as a sustainable advantage over their competitors. Baronchelli and Cassia (2011) noted that mature business people elected for a better adjusted orientation towards the enterprise, with less reliance on using the latest technology to draw customers but with more emphasis on what the market dictates (Andersson, 2004).

Entrepreneurial experience is an invaluable asset because it provides a source of direct learning and episodic knowledge. Launching an enterprise is a daunting and complex

task and any prior experience in this regard, is a distinct advantage. There are two types of entrepreneurial experience, namely, task specific human capital, and industry human capital. The former is necessary experience for starting up a venture and managing an existing venture. Successful entrepreneurs who have managed firms previously have historical data and entrepreneurial memory in terms of trials and errors, resource mobilisation and decisions and implications thereof. On the other hand, industry specific human capital has an impact on the performance of a new firm. This relates to the founder's experience in the tasks and skills that they have acquired in previous industries in which they have worked, rather than the skills learnt from managing a start-up.

Unger *et al.* (2010) observed that human capital was responsible for high performance in organisations, if embedded in task specificity. Task specific human capital includes start up experience, industry experience as well as entrepreneurial knowledge. Shane and Venkataraman (2000) further said in entrepreneurship, task specific human capital would be indispensable in environmental scanning, strategy formulation, management, as well as leadership. Alvarez and Barney (2002) added that in particularly difficult times, human capital could influence new opportunity recognition in creating new firms, because of the idiosyncratic nature of their entrepreneurial judgement. He added that persons with greater academic accomplishments, industry-specific human capital as well as entrepreneur-specific human capital, would lead to better entrepreneurial judgement. It goes without saying therefore that owners of task specific human capital have more customer knowledge that is intimate to their customers, suppliers, products and services (West & Noel, 2002). As such, holders of this human capital are better poised to seize neglected opportunities and make strategic choices for a prosperous firm.

Further analysis revealed that people with entrepreneurial experience had a higher likelihood to undertake high-risk situations in business, because of their ability to assess the potential for returns. Coombs *et al.* (2009) concluded that the wealth of knowledge amassed over the years had positively affected their levels of self-belief and good repute, such that they could spread the risk with likeminded persons; and as such, create a culture of individuals who are risk averse. The influence of having employees with business know-how and empire-building watchfulness was tested with regard to identifying prospects (Li, Wang & Liang, 2015) and it was found that there was a direct relationship between these constructs. The entrepreneur's ability to identify the viability

of prospects in business is a fundamental process to find something 'with' to add business value (Ardichvili, Cardozo & Ray, 2003). Cognitive psychologists also discussed opportunity recognition from two viewpoints; the feature analysis model, which confirmed that experience, and attentiveness in business directly linked to recognising opportunity. The other opinion is the 'models of pattern recognition'. This means that commercial entities become easier to develop for experienced entrepreneurs, as the mental reasoning framework, business outline and trial product became assimilated into a familiar combination (Alvarez & Barney, 2007; Ács & Audretsch, 2010). As a result, as they create more ventures, the more they garner proficiency and understanding and can spontaneously isolate intricate patterns that present themselves in business development (Baron, 2006).

Analysis in the work of Zaleski (2011) revealed that external financiers attached much importance to the entrepreneur's expertise for the following reasons. Firstly, industry specific proficiency on the business owner's part is about the firm's ability to thrive and develop further. Secondly, a business owner who has an established record offers trustworthiness to any knowledge he or she may dispense. Entrepreneurial experience as a managerial competency is an organizational advantage. Managerial competencies are sets of knowledge, skills, behaviours and attitudes that contribute to personal effectiveness (Hellriegel *et al.*, 2008). Managerial competencies are very important to the survival and growth of new SMEs. Martin and Staines (2008) found that lack of managerial experience and skills are the main reasons why new firms fail. Finding employees who have entrepreneurial experience within organisations, such as growth firms, is also positive. In this regard, entrepreneurial experience serves a dual purpose; commercial forecasts are realistic and well informed and external finances are more likely to invest in firms where an experienced individual has made projections.

H2b: Entrepreneurial experience is positively correlated to growth in high technology firm

2.5 INFORMATION TECHNOLOGY INFRASTRUCTURE FLEXIBILITY

In the past, flexible infrastructure was considered to be a complex asset because measuring it was a challenge, as little consensus had been achieved in terms of its

operational definition (Duncan, 1995a). Senior officials in other establishments found it difficult to substantiate the steep expenses on infrastructure, because at the time, it was difficult to create a linear connection between expenditure and direct benefits. The argument for flexibility has steadily been perceived as a prerequisite for enabling innovation. In most instances, inflexibility is demonstrated in the challenges faced by developers with the consumer's unmet demands, where he or she may require the system to do what it was not programmed to do. Kaplan (2004) noted that previously creating new systems or creating new processes to deal with the system's inadequacy solved inflexibilities. Now, however, IT infrastructure flexibility concerns the responsiveness of organizational applications to business requirements. Egyedi (2001) highlighted the fact that growth technology firms were stuck with large technological systems that were resistant to variation.

According to Koskinen, Luomala and Maaranen (2012), research on elementary papers on flexibility in the context of the manufacturing sector labeled it as the firm's capability to react to organizational modification of systems as demanded by the client's needs within and outside of the firm. Chung, Rainer and Lewis (2003) described infrastructure flexibility as an essential structural proficiency for firms to endure in an ever evolving business environment. Conboy and Fitzgerald (2004) noted that flexibility is not only a process where an organization become familiar with the demands of a high paced organization, but it also becomes a two way process, where the organization would also influence the development of ideas. Chesbrough (2003) highlighted that flexibility is important to roll out new technological advances within the organization and facilitate consistent feedback in order to moderate complex and tedious business processes. One of the fundamental characteristics of modern business is the rapidly changing environment. Information Technology (IT) infrastructure is an enabling foundation for business applications and it may support innovation in business processes. In the past, it was a common belief that IT infrastructure could be a source of competitive advantage; and more recently, more authors have been referring to the flexibility of the infrastructure as the secret weapon for competitive advantage (Byrd & Turner 2000). IT infrastructure flexibility was referred to as the extent as to which the infrastructure is modular, scalable and has the proficiency to address existing business applications (Byrd & Turner 2001). The competitive advantage is derived in easy automation, high technology manoeuvres

and the difficulty to imitate the infrastructure. Bhatt (2010) described flexibility as the ability to rapidly disseminate information and respond to environmental change. He argued that flexibility is a fundamental component in IT infrastructure because it bolstered growth by enhancing an organisation's ability to handle increases in customer demands, without increasing costs. Specifically, IT infrastructure enables the firm to innovate more easily because of the access to information across several platforms and the ease of altering business processes. Chun *et al.* (2003) agreed that IT infrastructure could provide tangible benefits and transitions in business processes. IT infrastructure is comprised of IT components (computer and communications technologies and IT personnel), which provide shared IT services (e.g., providing electronic data interchange capability, and managing corporate databases). The IT infrastructure provides the functionality delivered by business applications (e.g., point-of-sale data capture, order entry, sales analysis, purchasing systems). He added that IT infrastructure alone however was not enough to achieve these benefits; infrastructure flexibility was instrumental to achieving these goals.

Previous researchers have argued that Information and Communication Technology (ICT) capabilities could be a central facilitator for enhancing other capabilities of a firm (Morabito *et al.*, 2010; Kohli & Grover, 2008; Sambamurthy *et al.*, 2003; Marchand *et al.*, 2000). Mithas *et al.* (2011) said ICT capabilities are a firm's ability to employ a varied selection of deliberate technologies for business purposes, ranging from elementary to very refined. In particular, we argue that ICT capabilities can be instrumental in enhancing network capability for several reasons. Firstly, the coordination of information between external parties is easier and secondly such capabilities help organisations access knowledge about their partners' needs and expectations (Mostaghel *et al.*, 2012; Southern & Tilley, 2000). Chen *et al.* (2015) defined ICT capabilities as one of four categories, which are IT management, IT infrastructure flexibility, IT integration and IT alignment. For the purposes of this study, infrastructure flexibility is the dimension under investigation.

Duncan (1995) described infrastructure flexibility in characteristics such as connectivity, compatibility and modularity. Compatibility refers to the ability to transmit information across any technological platform within the organisation, while connectivity is the ability of technological components to communicate with other components both within and

outside the organisation. Modularity is the ease of reconfiguration of technological components, thus enabling the standardisation of business processes for share-ability and reusability. The high technology industries have undergone what researchers have termed a turbulent environment, which may be due to the instability in technology or markets (Buganza, Dell'Era, & Verganti 2004). Van de Vrande *et al.*, (2009) also said such high technology firms, even if considered as a small business also faced challenges like fluctuating customer needs, intense competition and a greater need for flexibility. Previous research has cited that infrastructure flexibility has immense influence on the extent of business alignment and the implementation of core business applications Anwar, N and Masrek M.N Impact of IT Infrastrurcture flexibility on strategic utilization of Information Systems: A conceptual framework (2013). Advanced Computer Science Applications and Technologies 2013 International Conference (Chung *et al.*, 2003). Duncan (1995) advocated that infrastructure flexibility increased a systems developers' ability to design and build systems to meet organizational business objectives. Davenport and Linder (1994) stated flexible IT infrastructure is the core competency of innovative organisations and as such, is robust and effective. Further literature has lauded flexible IT infrastructure as responsive to swiftly mutating business conditions. Luftman (1999) also linked a flexible infrastructure to strategic business-IT alignment by the application of IT in a manner that is suitable for and harmonious with corporate strategies.

2.5.1 Performance

Performance is a multi-dimensional concept and it may depend on the indicators used as an assessment of performance. A litany of literature has shown varied performance indicators, the most common distinctions manifest between financial and non-financial dimensions. Murphy, Trailer and Hill (2006) said growth and measures of profitability characterised financial indicators. Business managers may perceive the latter as success and providing global ratings. In other areas of literature, operational performance is separate from, yet complementary to, financial performance (Britto *et al.* 2010; Wu & Chuang 2010; Inman *et al.* 2011; Saldanha *et al.* 2013). However, the literature offers conflicting support regarding the nature of the relationship between operational performance and financial performance, for example, in their study of agile manufacturing, just in time production and purchasing, and several performance

measures. On the other hand, Inman *et al.* (2011) found no direct relationship between operational performance and financial performance.

Organizational performance is the transformation of inputs into outputs for achieving certain outcomes (Chen, 2002). Ullah (2013) operationalised it as the linkage between least and effective cost (economy), between effective cost and realised output (efficiency) and between output and achieved outcome (effectiveness). Yukl (2006) defined effectiveness of the organisation as a concept that was determined by three basics performance elements.

- Efficiency and process reliability
- Human resource and relations
- Innovation and adaptation to the environment.

Jung and Avolio (200) defined operational performance as measured in three ways: Quantity of ideas, quality of ideas, and persistence on the task.

Various authors have previously alluded to the influence of the concept of 'dynamic capabilities' in innovation studies. Teece (2009) made reference to a triad principle, the "dynamic capability" concept, where firstly, firms need to possess the proficiency to anticipate and create the firm's strategic profile in terms of coming up with novel ideas. Secondly, firms need the capacity to take hold of the ideas generated and subsequently execute them. The final capacity is the firm's predisposition to alter itself and not suffer elimination in the market because of poor adaptability and over-reliance on previous accomplishments. If dynamic capabilities are underpinned on the enterprise-level competitive advantage in dispensations of swift technological advancements, its linkage to sustainable firm performance is imperative.

Taking this into consideration, the dynamic capabilities, as mentioned by several researchers, have also focused on examining the relationships among dimensions of operational performance (Barreto 2010; Lin & Huang 2012). Although research in this area has been growing at an increasing rate for more than a decade, it appears still in its infancy as ambiguity remains with the many definitions, different uses of terminology, need for new conceptualisations, and mixed findings of various studies (Wang & Ahmed, 2007; Easterby-Smith, Lyles, & Peteraf, 2009; Barreto 2010).

According to Ojha, White and Rogers (2013), operational performance is composed of the two constructs of lower inventory and lower costs. The former is about raw materials, Work-In-Progress (WIP) and finished goods. The former is in relation to scrap and rework costs, unit manufacturing cost and the costs of purchasing materials.

McAfee (2006) noted that the infiltration of ICT in firms, has also beset management with challenges. He delineated the tiers of IT in terms of functional, network and enterprise IT.

Table 1 1The varieties of work changing Information Technology (McAfee 2006, p. 145)

Category	Definition	Characteristics	Examples
Function IT	IT assists with the execution of discrete tasks	• Can be implemented without complements • Impact increase when complements are in place	Simulators, spreadsheets, statistical software, Computer Aided Design (CAD)
Network IT	IT that facilitates interactions without specifying the parameters	• Does not impose complements, but lets the result emerge over time • Does not specify tasks or sequence • Accepts data in many formats • Use is optional	Email, instant messaging, mash ups, blogs, wikis
Enterprise IT	IT that specifies business processes	• Imposes complements throughout the organization • Defines tasks and sequences • Mandates data formats • Use is mandatory	Software for enterprise resource planning, customer resource management and supply chain management

With regard to Function IT, management has a duty to generate components to balance IT and increase the use of complements as they increase aptitude for conducting system trials and accuracy. In the case of Network IT, management is responsible for setting the standards for use, and expediting teamwork, as it is voluntary. IT infrastructure flexibility is most relevant to enterprise IT, where the intention is to streamline cross functional

business processes, standardize work activities and increase efficiency, however to the detriment of employee independence.

2.5.2 The relationship between IT infrastructure flexibility and operational performance

Ray *et al.* (2005) said a flexible IT infrastructure is a multifaceted set of technological resources carefully planned for and developed over time. Due to its path dependent nature, there can be substantial variations across businesses in how their infrastructure is organised (Ray, *et al.* 2004). According to Broadbent and Weill (1997), the differential flexibility of firms' IT infrastructure makes the cost, pace, and value of IT-enabled innovation different for different firms and as such, flexibility in infrastructure can be a source of competitive advantage. Boyer *et al.* (1997) undertook research to examine whether investments in advanced manufacturing technologies (AMTs) such as flexible manufacturing systems (FMS), are more likely to lead to improved performance if they were supported by developments in the manufacturing infrastructure of the company. The results suggested that a linkage existed between the adoption of advanced manufacturing technologies and investments in infrastructure. It was found that organisations that invested in both AMTs and the flexibility of infrastructure performed better than firms which only invest in one or the other. The operational performance of the business is further affected by flexible IT infrastructure through the rapid development and implementation of IT applications that augment customer service process performance (Ray *et al.* 2005). This makes the organisation more adept to further opportunity recognition, or the neutralisation of competitive threats. The enabling nature of an IT infrastructure is most evident in the extent to which a firm adopts standards for the components of its IT infrastructure, e.g. these could be for hardware, operating systems, network, data, and applications because these could be shared and accessed throughout the organisation (Broadbent & Weill 1997). Yli-Renko (2001) noted that shared expectations and goals diminished the need for formal monitoring, allowing firms to invest more effort into knowledge assimilation and exploitation. The author added that shared expectations and goals also endorsed the establishment of compatible systems and cultures that would supply new external knowledge. New

knowledge exposes the firm to a new range of new value opportunities for operational performance.

P1: Information Technology infrastructure flexibility (ITIF) will enhance operational performance, which is positively correlated to growth in high technology firm

2.6 GROWTH

Moreover, firm growth is the gateway to the introduction of innovations and technical change in a business seeking competitive gains in order to face the market from a better position (Pagano & Schivardi, 2003). A review of prior academic work on firm growth suggested that organisation growth is defined differently and can look very different across all growth firms. According to Delmar *et al.* (2003), the varied growth metrics have affected the model building and theory development. Several scholars were of the opinion that there should be “one best way” of measuring growth and this had diverted researchers from acknowledging that firm growth was fundamentally multidimensional, taking into account that high-growth firms did not grow in the same manner. Audretsch (2012) noted that ‘growth’ as a definition lacked a well-defined and unambiguous stance. There are several terms being used in reference to growth and such words include rapid or extraordinary. An organisation that has grown beyond expectation of the Gross Domestic Product (GDP) is also considered to be growth (Barringer *et al.*, 2005). Barbero *et al.* (2011) described it as an organisation that had seen a minimum of 10% annual growth over a five-year period. A more popular definition is that of the Organisation for Economic Cooperation and Development (OECD) (2007) that defined IT as a firm with an average annualised growth greater than 20% per annum, measured over a three-year period and with ten or more employees from the point of observation. In this case, therefore, growth is perceived as turnover and the growth in staff complement.

In a study conducted by Gundry and Welsh (2011), high-growth-oriented or herein referred to as ambitious entrepreneurs, are distinguished from low-growth-oriented “status quo” entrepreneurs by actual firm growth rates as measured by sales growth. The use of sales growth as a valid determinant of firm growth has been well documented in entrepreneurship research (Ginn & Sexton 1989; Hoy, McDougall, & D’souza 1992).

Barringer *et al.* (2005) noted that rapid firm growth is often an indication of market acceptance and organizational triumph. To that end, companies such as Apple, Cisco and Oracle have seen rapid growth that has opened more subsidiaries, which have also pioneered novel products and services. According to Delmar *et al.* (2003), literature on rapid growth is not as fragmented and limited, as they found a litany of work where four categories of attributes of rapid growth were discussed. These were founder characteristics, firm attributes, business practices, human resources practices. The category for founder characteristics included higher education, relevant industry experience and prior industrial experience. Goal setting and commitment to growth are the firm attributes. The section on business practices addressed issues on niche markets, unique value addition, and customer knowledge. Lastly, human resources planning is about employee empowerment, staff hiring and stock options. Nerlinger (1999) did a study on which factors mattered for growth in New Technology Based firms (NTBFs). His work focused on the following attributes of firm specific characteristics, founder specific characteristics and external attributes. He found, for instance, that firm-specific characteristics (other than age and company size) had an influence on the growth rate. An example is the attribute of firms with 'limited liability' that enjoyed significantly higher growth rates than firms in which the founders are liable with their own personal fortune. In addition, the importance of individual abilities and skills of the founders is clearly illustrated in the positive correlation between technical degrees ("Skills Tec") and growth of NTBFs and of young non-innovative firms.

Firm growth is a dynamic gauge of a worthwhile business. If the enterprise is growing, it is considered effective, as more opportunities for creating jobs is higher and advances the contribution to the well-being of communities. A few years ago, the world endured an economic recession that invariably frustrated the entrepreneurial aspirations of organisations and individuals alike. Peric and Vitezic (2016) conceded that despite the economic downturn, some entities managed to grow in spite of the odds. It is consequently fundamental to appreciate the dynamics and developments that cause high firm growth and stay resilient, with special focus on high technology firms.

Growth is a surge of sales, the rise of market share, increase of a firm's assets or the increase of a firm's own capital or a combination of the above-mentioned elements. Growth has numerous suggestions and can be evaluated in terms of deals, workers,

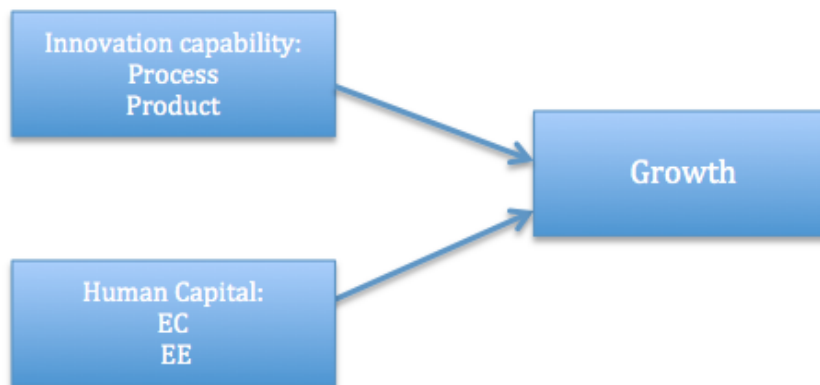
possessions, revenue and equity, among others (Wiklund *et al.*, 2009; Gupta *et al.*, 2013).

National policy regimes often have effects on the industrialization tangent that a government will pursue and implement and it has altered the state of affairs in which the companies had been conducting business. Over the last twenty years, the Indian automobile industry has undergone major transformation. In the last two decades, the Indian auto industry has emerged as one of the fastest emergent industries' manufacturing hub and has a high technological growth spurt (Patra & Rao, 2016). In this period, the government reduced the import levies for auto-related imports and tax incentives were introduced for the creation of mergers with locals as well as the rollout of new technological innovations to advance performance.

The Auto-Policy of March 2002 is one of the central policy documents that transformed the competitiveness of the Indian automotive industry. This is because this policy relaxed stringent import regulations and paved the way for local firms to advance as global players and acquire foreign organizations.

When companies face rapid growth, it may be attributed to three human resource competences, strategic aspects and the organization's characteristics. If the behavior of employees is entrepreneurial in its outlook, it will have an effect on the viability of the enterprise. This is manifest in the following attributes: innovative and preemptive conduct and the willingness to take risk (Mateev & Anastasov 2010). Wiklund, Pätzelt and Shepherd (2009) confirmed how great an impression entrepreneurial orientation has had on the advancement of firms, especially those with intentions to internationalize as part of their expansion plans. It was reported that issues such as the strategic goals, the differentiating approach from other services or products in the market and the business model affected the profitability of the organization. The novelty of the product offering, especially in relation to distinctive expertise, proficiencies and awareness is complementary to the strength of the strategy as well. The last aspect is in relation to internal organizational attributes, including the legalities of the company status, the business locality and also how technically savvy it may be.

2.6.1 CONCEPTUAL MODEL



Information Technology infrastructure flexibility (ITIF) is likely to enhance operational performance, which we propose is positively correlated to growth in high technology firm.

2.7 CONCLUSION OF LITERATURE REVIEW

This review discussed the merits of IT infrastructure flexibility as a mediating influence on innovative capability, human capital and the growth of high technology firms in the Gauteng province. The literature confirmed that innovative capability enhances the valuation of a firm because it affects the internal technical competencies on opportunity recognition and competitiveness. Human capital brings to the fore how difficult it becomes to imitate technical acumen in the organisation, especially when staff has strong entrepreneurial competency or experience. It renders them ultra-sensitive to anticipate changes in the economy, marks and in terms of opportunity recognition. Although sparse empirical evidence exists on infrastructure flexibility's influence on growth, infrastructure flexibility is a construct touted as an organizational enabler for competitiveness.

2.7.1 Hypothesis / Proposition / Research Question 1:

H1a: Process innovation is positively correlated to growth in high technology firm

H1b: Product innovation positively correlated to growth in high technology firm

2.7.2 Hypothesis / Proposition / Research Question 2:

H2a: Entrepreneurial competency is positively correlated to growth in high technology firm

H2b: Entrepreneurial experience is positively correlated to growth in high technology firm

3 CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This segment outlines the procedure used to conduct this research, starting with a deliberation on quantitative research followed by an appraisal of the research design, which includes the research population and sample, the research instrument used, as well as the research paradigm to be undertaken. Matters relating to data collection and analysis in relation to the work are provided. The ethical considerations were considered in this research.

3.2 RESEARCH METHODOLOGY / PARADIGM

The study has cited a theoretical paradigm and Krauss (2005) defines this as the foundational source on which a systematic evaluation is made or a collection of credibly held conventions and conjectures that influences research. This research report conforms to the positivist paradigm because it allows for deductive reasoning (Hyde, 2000). A positivist epistemological position is best because of the objectivity it offers the researcher. The study is quantitative research. Quantitative research allowed for enumeration of collected data and it was exposed to statistical handling in order to support or contest different knowledge claims (Creswell, 2003). According to Kim (2003), positivism is founded on the idea that certain universal laws directed societal occasions and once a researcher understood these laws, they could foresee, describe and control occurrences. Sanders *et al.* (2000) imagined that investigators were independent of the research or that they were not affected nor were they part of the inquiry. Furthermore, Hype (2000) states that with deductive reasoning, the report can fit to the positivism paradigm; furthermore the work outputs are objectives of researchers as the findings were made plus confirmed, through open observations and measurements of the events. The positivist epistemology approach is the most unbiased for a researcher, as defined by Wilson (2014). This research focused on a quantitative method, which allowed for listing of collected statistics as well as it was exposed to numerical management in order to support or approve of diverse information claims (Creswell 2003).

According to Newton and Suter (2006), quantitative study is the instrument that is best to test the hypotheses through statistical values. Furthermore, this is useful to generalise the results to the population of the representative sample. This study has been influenced by reflexivity, where this should not be exploited as a wilful focus on the researcher's objectivity, but rather it should be used as a facilitator for understanding and for deeper insight (Finlay 2002).

3.2.1 Epistemological and ontological considerations

Epistemology is defined as a derivative of the Greek word 'episteme; which means knowledge (Krauss 2005). According to Symon and Cassell (2012), epistemology is referred to as the type and extent of knowledge and the method in which it can be obtained. Another related concept is ontology. Ontology is the viewpoint of reality and the state of being (Bryman & Bell, 2007). In earlier studies, other authors have published work on the topical deliberations regarding the innovative capability and firm growth of different countries (Easterby-Smith, Lyles & Peteraf, 2009; Kale, 2012). This body of work has captured the essence of real time events of individuals working within the high technology sector in South Africa. The timing of the research is especially prudent, as it comes against the backdrop of the erratic financial shocks the economy has suffered in recent months. Karodia, Rehman and Soni (2016) lamented the declining investor confidence in the country, the downgrading of South Africa's currency by rating agencies to 'junk status' and a depressed growth course, among other crises. Undoubtedly, such events will affect the country's efforts to make tangible transitioning strides towards asserting herself as an internationally competitive force. Although research did not delve deeply into how such would explicitly affect the high technology sector, diminished optimism from respondents is anticipated.

3.3 RESEARCH DESIGN

The methodological approach that was adopted is cross survey sectional research (Creswell 2013). This study consisted of an empirical study. The empirical approach consisted of primary research and the collection of data through the use of questionnaires. Initially, the questionnaire was distributed in a paper based format to

industry companies, which saw little positive results. It was difficult to get participants in this study as many participants feared organizational reprisal, despite being assured of the confidentiality of this study. It was also difficult to get most responses back as for further analysis. Thereafter, an electronic questionnaire was then developed on Qualtrics, where a link was distributed to companies in the industry as well industry players in the high technology space. Data collection was facilitated mostly through the contacts and networks of the researcher and through the administration offices of local high technology businesses. A better response rate was achieved, sent out link to 250 respondents, 123 responded, 28 incomplete/invalid and remained with 95, and 6 had no business age, 2 were businesses less than 3 years and 5 where in government department which weren't in high technology. From there we received a response of 66%.

Past research has used questionnaires in measuring the variables (Chen, Gully & Eden, 2001; Zellweger, Sieger & Halter, 2011), hence the research adopted the same approach. The instrument used in this study was a structured questionnaire. The questionnaire comprised structured questions which would made it easy for the respondents to indicate their views. The use of five-point Likert scale questions enabled respondents to indicate their opinion on various factors of innovative capability, human capital and the extent of infrastructure flexibility available.

3.4 POPULATION AND SAMPLE

3.4.1 Population

The study was open to all employees in high technology firms in Gauteng. Masutha (2015) revealed that there are numerous businesses that operate in high technology organisations from different sectors, which have shown significant growth. The population was derived from numerous sectors, including, but not limited to, sciences, Information Communication Technology (ICT), pharmaceutical, motor industry, manufacturing, aerospace, mining, biotechnology and mobile technology and communications.

3.4.2 Sample and sampling method

The study achieved 123 respondents from employees in high technology businesses, engineers, R&D department, accounts department, sales and other relevant departments to the survey, even in state organisations. Respondents were requested to participate in the survey, and these should have had a minimum of three years in the service of the respective organisation.

Tabel 2.1 Profile of respondents

Description of respondent type	Number sampled
All employees in R&D department, accounts department, sales with a minimum of 3 years' experience within the company	123

3.5 THE RESEARCH INSTRUMENT

Sections A and B addressed biographical data primarily, and B about the business in terms of its strategic orientation, founders and the longevity of the business. IT Infrastructure flexibility (C 1-9) is the first variable to be operationalised by nine items adapted from Byrd and Turner (2000). Respondents were requested to make their comments from a range of Strongly Disagree to Strongly Agree. The Cronbach alpha scores were tallied at 0.88. Dimensions in product and process innovation specifically addressed innovative capability respectively (D1-D10). A five-point Likert scale was also the standard in this regard. The scales were adapted from work published by Hogan *et al.* (2011). Reliability and validity was measured at 0.82. The Human capital construct represented dimensions on Entrepreneurial competency (E1 –E8) and was addressed through the questionnaire adapted from Chandle and Jansen (1992). Cronbach reliabilities was scored at 0.7. The last variable is performance/growth which was adapted from Murphy (1996).

3.6 PROCEDURE FOR DATA COLLECTION

3.6.1 Statistical Package

The data were collected using a Qualtrics online portal. The data was downloaded into an SPSS file. The analysis was conducted in SPSS.

3.6.2 Descriptive Statistics

Descriptive statistics such as the mean, standard deviation and frequencies were used to summarise data. Frequencies were mainly used for categorical variables and ordinal data while means and standard deviations were used for metric variables.

3.6.3 Factor Analysis

Exploratory factor analysis was carried out to assess the validity on constructs. Validity refers to the extent to which a scale or set of measures accurately represents the concept of interest. The convergent validity, which is shown by factor loadings provided in factor analysis output, refers to the amount of weight assigned to the factor. Here we are interested in significant factor loadings. Factor loadings less than 0.4 were considered to be insignificant and hence removed from the model. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was used to assess the adequacy of the sample to run factor analysis. A KMO value greater than 0.5 is required for the adequacy of the sample. The Bartlett's Test of Sphericity was used to assess whether there was interdependence between items within the same construct. A p-values less than 0.05 is the minimum requirement for the Bartlett test.

3.6.4 Cronbach's alpha

Cronbach's alpha was used to assess the internal consistency (reliability) of all multiple item scales. Internal consistency describes the extent to which all the items in a multiple item scale measure the same concept or construct. The value of the Cronbach's Alpha ranges from zero to one and the closer the Cronbach's alpha coefficient is to 1, the greater the internal consistency of the items in the scale. The following table shows how the reliability can be classified based on the Cronbach's Alpha value.

Tabel 3. 1 Cronbach's Alpha Classification

Cronbach's Alpha Value		Reliability
>0.9		Excellent
>0.8		Good
>0.7		Acceptable
>0.6		Questionable
>0.5		Poor
<0.5		Unacceptable

3.6.5 Pearson's Correlation

Pearson's correlation analysis, which is a measure of the strength of a relationship between two variables, was applied. Pearson correlation coefficients is said to be weak if between 0 and 0.29, moderate if between 0.3 and 0.49, and strong if between 0.5 and 1 (Cohen 1988). The sign of the correlation coefficient shows the direction of the relationship. A positive correlation means that as one variable increases, the other variable increases as well, while a negative correlation coefficient implies that one variable increases as the other one decreases, and vice versa. A p-value of the Pearson's Correlation less than 0.05 implies that the relationships is significant while a p-value greater than 0.05 is an indication of an insignificant relationship.

3.6.6 Multiple Regression Analysis

Multiple Linear Regression analysis is a procedure used to predict the variance in a dependent variable based on linear combinations of interval, dichotomous, or dummy

independent variables. It was used to assess the causal relationship between independent variables and business growth. Hierarchical multiple regression analysis was used to assess whether there was a mediation relationship. The first condition for testing for mediation is that the independent variable significantly relates to the dependent variable. The second condition is that the independent variable significantly relates to the mediator. The third condition is that the moderating variable is significantly related to the dependent variable controlling for the independent variable. The final condition is that the addition of the moderator variable to a model with the independent variable will significantly reduce the contribution of the independent variable to the prediction of the dependent variable. The Sobel test was conducted to test whether the mediator variable (Performance) carries the influence of an independent variable (Process Innovation) to the dependent variable (Growth). A p-value of less than 0.05 for the Sobel test indicates that the mediation relationship is significant.

3.7 Data analysis and interpretation

Data were scrutinised statistically using the SAS programme version 21.

The analysis included descriptive statistics using standard deviation and correlation between variables and regression analysis to develop deductions for the population. Confirmatory Factor Analysis was necessary per construct. The researcher also needed to use multiple regression analysis using mediation (Baron & Kenney, 1986).

3.8 Limitations of the study

The report was presented in a cross sectional framework and thus removed the insights that longitudinal study may have presented (Callaghan 2009). This study does have a number of theoretical and empirical limitations. First of all, the study is focused on phenomena in a selected industry so it may not be valid in other contexts. Causality is a challenge in the study and it is often not established, at best an association can be verified but cannot be implied (Bryman 2015). Factors such as environmental differences, extent of government interventions and industry characteristics could suggest a different set of growth strategies for another location. Findings from the case

studies and questionnaire survey may not be applicable to other countries in different regions. A primary critique to entrepreneurial-based studies is that the sample size was too limited (Levie *et al.*, 2009; Athayde, 2012) and the results could not be generalised, because of the lack of having control of groups and an over-reliance on cross-sectional study. Short *et al.* (2010) mentioned that research in entrepreneurship-conducted firms from a management perspective is more helpful for practitioners than for academics because of its practicality. As mentioned above, because the study used one distinct methodology of quantitative research and the lack of mixed methods may have robbed the study of further perceptions and understanding.

3.9 Validity and reliability

3.9.1 External validity

Reliability and validity are undoubtedly the hallmarks of good measurements and the keys to assessing the trustworthiness of any research study. First the questionnaire was pre-tested in a pilot study. In addition, the reliability of the study was ensured by using the Cronbach's alpha, derived from past research instruments in the literature review. The external validity of research findings is the data's ability to be generalised across persons, settings, and times (Cooper & Schindler, 2008). The researcher attempted to achieve external validity by sampling respondents from the CQS Audit Company, a firm specialising in the design, development and deployment of software solutions for financial professionals in Gauteng.

3.9.2 Internal validity

To enhance internal validity, the researcher made sure that the actual research instrument measured what it purported to measure (Easterby-Smith 2008). The researcher attempted not to be time consuming. The questionnaire consisted of a set of short and comprehensive questions thereby preventing the respondent from becoming tired, bored or uninterested. Therefore, it did not have a negative influence on the responses. The questionnaire was edited post the pilot stage to avoid ambiguity and

thereby confusing the respondents. The questions were kept short yet comprehensible thereby preventing the respondents from becoming fatigued or uninterested.

3.9.3 Reliability

A measure is said to be reliable to the degree that it produces consistent results (Cooper & Schindler, 2008). Internal consistency reliability indicates the consistency with which the respondents responded to the questions on the scale. It indicates the degree to which the items in the instrument are homogeneous and reflect the same underlying construct (Cooper & Schindler, 2008). The researcher edited and reviewed scales used to ensure that questions were not perceived as ambiguous.

The reliability scales for human capital (Entrepreneurial competency): were adapted from Chandle and Jansen (1992). Cronbach reliabilities was scored at .0.7. Innovative Capability (Process and product innovation): Hogan *et al.* (2011), with the use of a five-point Likert scale. Cronbach scores were recorded at 0.82. Infrastructure Flexibility: The questionnaire was divided into three sections where issues of compatibility, connectivity and modularity were assessed. Scales derived from the work of Byrd and Turner (2000), used a five-point Likert scale. Cronbach reliabilities scored at 0.88. The scales to measure growth were used by Murphy (1996). Furthermore, Wiklund, Davidson and Delmar (2003) utilised this scale in their article "*What do they think and feel about growth: An expectancy-value approach to small business managers' attitudes towards growth*".

3.9.4 Research Ethics

It is the responsibility of the researcher to protect the rights of all those who may be involved in research activities and be responsible for all the outcomes. Secondly, the researcher's responsibility is to guarantee accountability to the wider associates of society. Bryman and Bell (2007) have sorted four areas as critical for researchers to pay attention to:

- If the researcher poses harm to respondents
- If any acts of deception have been involved
- If a lack of informed consent exists

- If there has been an invasion

Guillemin and Gillam (2004) revealed two types of ethical issues to be taken into consideration. These are procedural ethics that are more concerned with the request for approval from all appropriate structures and then there is ethics-in-practice which are the everyday decisions of which researchers need to be mindful. The researcher respected ethical obligations as he made a request to people and organisations to conduct the research which was approved.

3.10 CONCLUSION

The researcher used a quantitative, descriptive survey design. The questionnaires were administered by the researcher and subsequently electronically administered to collect the data from a convenient sample of 123 subjects. The questionnaires had both closed and open-ended questions.

An informed consent was obtained from the subjects themselves. The researcher went to great lengths to afford and ensure the anonymity and confidentiality of subjects during administration of the questionnaires and report writing with the utilisation of Qualtrics. Questionnaires were distributed to subjects to ensure validity. Reliability and validity were further increased by pretesting the questionnaire. This chapter described the research methodology, including the population, sample, data collection instruments as well as strategies used to ensure the ethical standards, reliability and validity of the study.

4 CHAPTER FOUR: PRESENTATION OF RESULTS

4.1 INTRODUCTION

This section discusses the presentation as well as the descriptions of the results. The results provide reasons as to what the high technology industry perceives as contributors to growth in high technology firms within Gauteng, focusing on Johannesburg. The findings of the constructs that were explored in the paper are presented.

4.2 DEMOGRAPHICS OF RESPONDENTS

A total of 123 respondents filled the questionnaire on qualtrics. Of the 123 questionnaires, 28 were incomplete, 6 did not indicate the business age of their organization, 2 were working for business that were less than 3 years old and 5 working for government. All these were excluded from the sample. The final sample had 82 respondents.

The distribution of 82 respondents by gender is summarized in Figure 2.

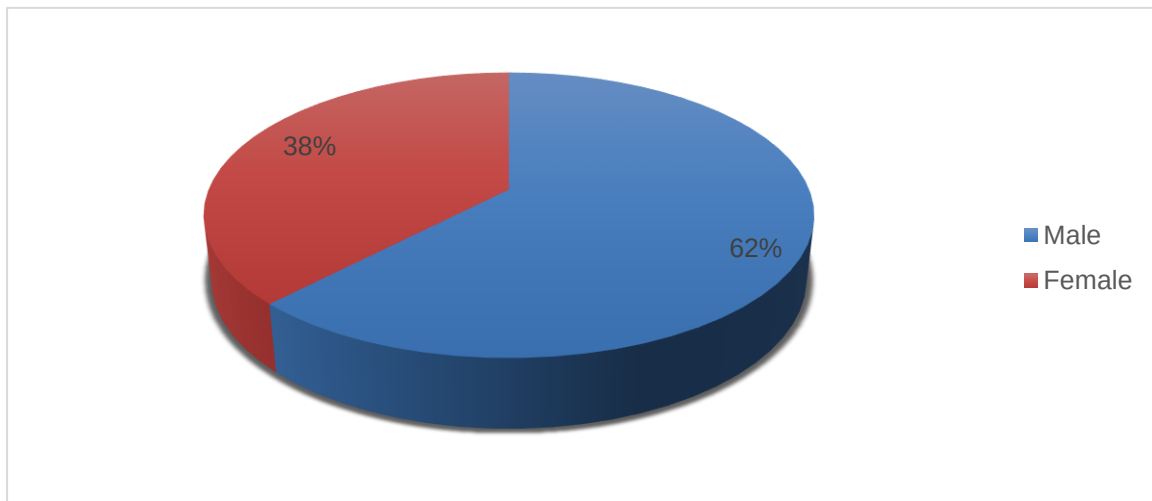


Figure 2: Gender

The sample was made up of 62% male respondents and 38% female respondents.

The business age and the number of locations that the businesses in the sample have in both the home country and overseas is shown in Table 4

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Business Age	82	3	197	36.59	43.653
How many locations does the business have in the home country and overseas	82	1.00	800.00	34.8415	110.12770

Table 4. 1 Business age and Number of locations

Descriptive Statistics						
	N	Missing	Minimum	Maximum	Mean	Std. Deviation
Business Age	82	0	3	197	36.59	43.653
How many locations does the business have in the home country and overseas	82	0	1	800	34.84	110.128

The businesses in the sample were on average 36.59 years old with the youngest business being 3 years old and the oldest was 197 years old. The number of locations from which the businesses operate from ranged from 1 to 800 and the average number of locations was 35 locations.

The distribution of the Primary Business Areas is summarized in Figure 2.

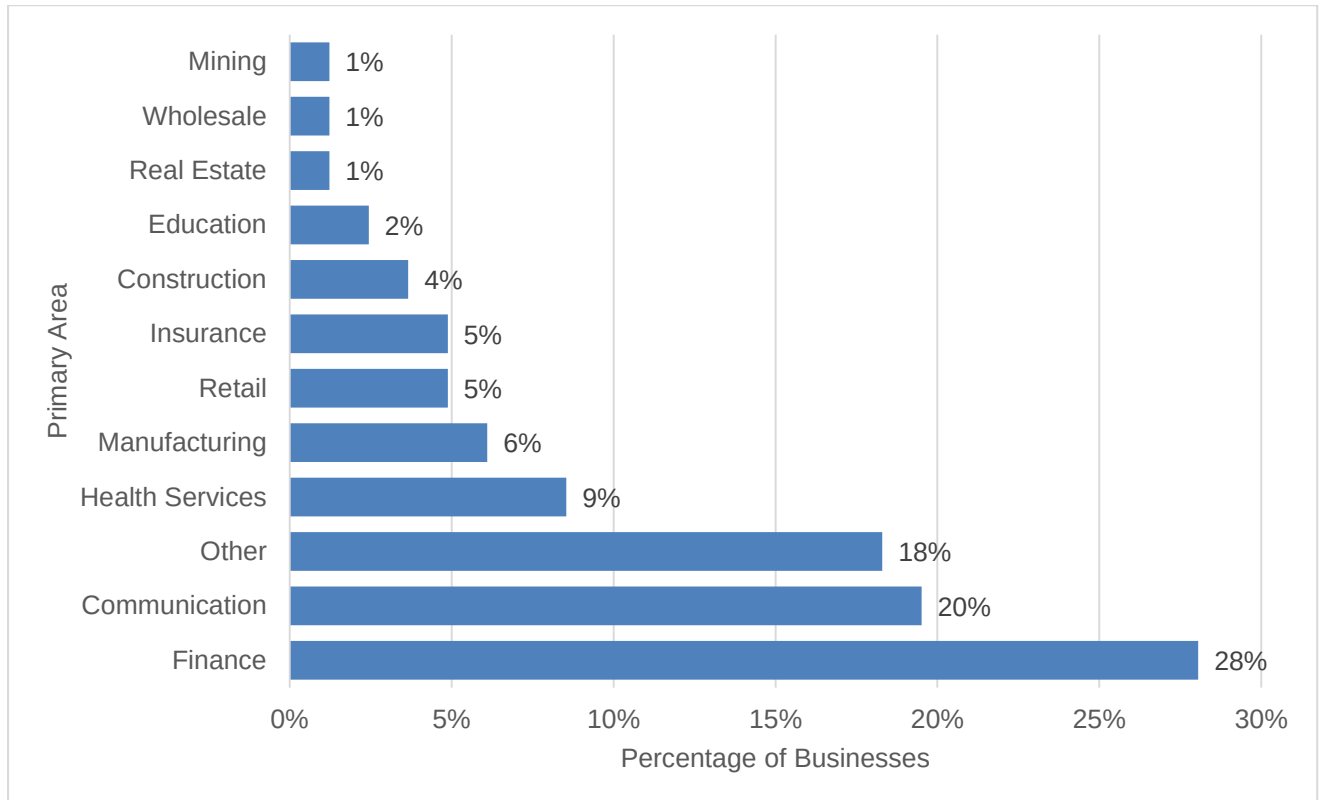


Figure 3: Primary Business Areas

The results show that 28% of the businesses had Finance as their primary business areas, followed by communication (20%) and other sectors (18%). The rest of the areas are summarized in Figure 2.

4.3 DESCRIPTIVE ANALYSIS OF THE SCALES

This section presents results of the descriptive analysis of the Infrastructure Flexibility, Company's Performance, Innovative Capabilities and the Human capital scales.

4.4 PROCESS INNOVATION SCALE

Table 5 shows the distribution of responses to the Process Innovation scale items.

Table 5. 1 Descriptive statistics for Process Innovation scale items

		N	Missing	Disagree - Strongly Disagree	Neutral	Agree - Strongly Agree	Mean	Std. Deviation
ProclInno1	Customers' request for customized Products	82	0	11%	17%	72%	3.83	1.052
ProclInno2	We enjoy an agile, flexible organizational structure that enables us to produce customized products very rapidly	82	0	18%	18%	63%	3.57	1.078
ProclInno3	Our organization is able to deliver a wide variety of products to special customer Orders	82	0	15%	17%	68%	3.73	1.019
ProclInno4	Concurrent engineering (e.g., simultaneously considering design, manufacture, and marketing of new products) is used much more in our organization than in those of our competitors	82	0	23%	46%	30%	3.09	.971
ProclInno5	The firm is agile and flexible, with an organisational structure that enables us to produce customised products very rapidly to be Industry Leaders	81	1	28%	19%	53%	3.38	1.179

The results indicate that more than 60% of the respondents either agreed or strongly agreed with statements ProclInno1, ProclInno2 and ProclInno3. A proportion of 53% either

agreed or strongly agreed with Proclnno5 while 30% either agreed or strongly agreed with Proclnno4.

4.5 PRODUCT INNOVATION SCALE

Table 6 shows the distribution of responses to the Product Innovation scale items.

Table 6. 1 Descriptive statistics for Product Innovation scale items

		N	Missing	Disagree - Strongly Disagree	Neutral	Agree - Strongly Agree	Mean	Std. Deviation
Prodlnno1	The time from product or service development to offering that product or service for sale is much shorter than our closest competitors	82	0	27%	29%	44%	3.21	1.003
Prodlnno2	The lead time to bring new products or services to the market is much shorter in our organization than those in our competitors	82	0	23%	39%	38%	3.21	.952
Prodlnno3	We have a high success rate in new products	81	1	10%	35%	56%	3.57	.865

The results show that respondents agreed the most with item Prodlnno3 which had 55% indicating that they either “agreed” or “strongly agree” with the statement. The respondents agreed the least with Prodlnno1 where 32% indicated that they either “agree” or “strongly agree” with the statement.

The descriptive statistics for the company’s business performance scale items are summarized in table 7.

Table 7. 1 Descriptive statistics for Company's Performance scale items

		N	Missing	Disagree - Strongly	Neutral	Agree - Strongly	Mean	Std. Deviation
Performance1	We have a high overall business performance and success	81	1	7%	15%	78%	3.85	.896
Performance2	Our Process (Transaction) productivity is high	82	0	9%	17%	74%	3.77	.851

The results show that respondents agreed the most with item Performance1 which had 78% indicating that they either “agree” or “strongly agree” while for statement Performance2, 74% indicated that they either “agree” or “strongly agree” with the statement.

The descriptive statistics for the growth scale items are summarized in table 8.

Table 8. 1 Descriptive statistics for Growth scale items

		N	Missing	Disagree - Strongly	Neutral	Agree - Strongly	Mean	Std. Deviation
Growth1	Sales growth is high vs competitors	82	0	12%	41%	46%	3.40	.873
Growth2	Profit growth is high vs competitors	81	1	16%	35%	49%	3.40	.958
Growth3	Company market valuation (Stock value) is higher than competitors	81	1	21%	47%	32%	3.15	.963

The results show that 49% of the respondents indicated that they either “agree” or “strongly agree” with the statement Growth 2 while 46% and 32% indicated that they either “agree” or “strongly agree” with the statements Growth1 and Growth3 respectively.

The descriptive statistics for the Innovative Capabilities scale items are summarized in table 9.

Table 9. 1 Descriptive statistics for Innovative Capabilities scale items

		N	Missing Disagree - Strongly Disagree	Neutral	Agree - Strongly Agree	Mean	Std. Deviation	
InnoCap1	Our company frequently tries out new ideas	82	0	18%	24%	57%	3.50	1.033
InnoCap2	Our company seeks new ways of doing things	82	0	9%	15%	77%	3.94	.907
InnoCap3	Our company is frequently the first to market with new products and services	82	0	24%	35%	40%	3.20	1.048
InnoCap4	Innovation is perceived as too risky in our company and is resisted*	82	0	51%	24%	24%	2.55	1.219
InnoCap5	Our new product introduction has increased during the last five years	82	0	15%	28%	57%	3.52	.946

It can be noted that the respondents agreed the most with item InnoCap2 which had 77% indicating that they either “agree” or “strongly agree” with the statement. This was followed by InnoCap1 (57%), InnoCap5 (57%) and InnoCap3 (40%). The respondent agreed the least with InnoCap4 which had 24% of the respondents indicating that they either “agree” or “strongly agree” with the statement.

There was only one item for the Entrepreneurial Experience scale and also one item for the Entrepreneurial Competency scale. The descriptive statistics for the 2 scales are shown in Table 10.

Table 10. 1 Descriptive statistics for Entrepreneurial Experience and Entrepreneurial Competency scale items

		N	Missing	Disagree - Strongly Disagree	Neutral	Agree - Strongly Agree	Mean	Std. Deviation
Entre_Exp	Large numbers of new products are launched compared with competitors	82	0	20%	50%	30%	3.16	.881
Entre_Compe	Company employees are continuously encouraged to bring new knowledge and ideas to the business and share their knowledge with their colleagues	82	0	18%	17%	65%	3.62	1.073

A proportion of 30% indicated that they either “agree” or “strongly agree” with the Entrepreneurial Experience item (Entre_Exp) while 65% either “agreed” or “strongly agreed” with the Entrepreneurial Competency item (Entre_Compe).

The descriptive statistics for the Human capital scale items are summarized in table 11.

Table 11. 1 Descriptive statistics for Human capital scale items

		N	Missing	Disagree - Strongly Disagree	Neutral	Agree - Strongly Agree	Mean	Std. Deviation
HC1	The competency of the company's employees as a whole is equal to the most ideal level (matching with their work	82	0	6%	24%	70%	3.80	.793

	requirements and responsibility)							
HC2	The company gets the most out of its employees when they cooperate with one another in team tasks	82	0	2%	23%	74%	3.98	.816
HC3	Company employees undergo continuous training programs every year	82	0	15%	20%	66%	3.61	.978
HC4	The ratio of educated personnel is on average compared with the industry (no. PhD, Masters and Bachelor degrees)	82	0	17%	40%	43%	3.27	.969
HC5	Company devotes a lot of time and effort to update and develops employees knowledge and skills	82	0	9%	32%	60%	3.61	.953

The results show that respondents agreed the most with item HC2 which had 74% either “agreed” or “strongly agreed” followed by HC1 (70%), HC3 (66%) and HC5 (60%). The respondent agreed the least with HC4 indicating that only 43% either “agreed” or “strongly agreed”

4.6 SCALE VALIDITY

The validity of the constructs was assessed using exploratory factor analysis (EFA) with Principal Factors. The variable “Innovation is perceived as too risky in our company and is resisted* removed as it had a factor loading less than 0.4” was removed from the Process Innovation construct as it had an anti-imagery of 0.308 which is less than the minimum acceptable value of 0.4. This item had its scale reversed before the EFA (i.e. 1 = 5, 4 = 2, 3 = 3, 2 = 4, 5 = 1) since it was negatively related to the rest of the items in the construct.

The item “The ratio of educated personnel is on average compared with the industry (no. PhD, Masters and Bachelor degrees)” was removed from the Human Capital scale as it had a factor loading less than 0.4

Table 12 shows the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity. As required, all the KMO values were greater than or equal to the minimum required value of 0.5. This shows that the sample was suitable to conduct factor analysis.

Table 12. 1 KMO and Bartlett's Test

Process Innovation		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.761
Bartlett's Test of Sphericity	Approx. Chi-Square	105.112
	df	10
	Sig.	.000
Product Innovation		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.664
Bartlett's Test of Sphericity	Approx. Chi-Square	75.818
	df	3
	Sig.	.000
Performance		

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	47.094
	df	1
	Sig.	.000
Growth		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.699
Bartlett's Test of Sphericity	Approx. Chi-Square	77.550
	df	3
	Sig.	.000
Innovative capability		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.731
Bartlett's Test of Sphericity	Approx. Chi-Square	71.241
	df	6
	Sig.	.000
Human Capital		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.674

Bartlett's Test of Sphericity	Approx. Chi-Square	77.080
	df	6
	Sig.	.000

The Bartlett's Test of Sphericity for Process Innovation ($\chi^2 = 105.112, p = 0.000$) indicated that the correlations between the scale items were large enough to run factor analysis. Product Innovation ($\chi^2 = 75.818, p = 0.000$), Performance ($\chi^2 = 47.094, p = 0.000$), Growth ($\chi^2 = 77.550, p = 0.000$), Innovative capability ($\chi^2 = 71.241, p = 0.000$) and Human capital ($\chi^2 = 77.080, p = 0.000$), all have a significant Bartlett's Test of Sphericity. This indicates that the correlations between the scale items were large enough to run factor analysis for each construct.

Table 13 indicates the final construct composition and the total variance in the items retained that is explained by each construct.

Table 13. 1 Validity of scale

Construct	Code	Items	Factor Loading	Total Variance Explained
Process Innovation	ProclInno2	We enjoy an agile, flexible organizational structure that enables us to produce customized products very rapidly	.810	53%
	ProclInno3	Our organization is able to deliver a wide variety of products to special customer Orders	.805	
	ProclInno1	Customers' request for customized Products	.725	
	ProclInno5	The firm is agile and flexible, with an organisational structure that enables us to produce customised products very rapidly	.718	

		to be Industry Leaders		
	ProclInno4	Concurrent engineering (e.g., simultaneously considering design, manufacture, and marketing of new products) is used much more in our organization than in those of our competitors	.542	
Product Innovation	ProdInno2	The lead time to bring new products or services to the market is much shorter in our organization than those in our competitors	.889	70%
	ProdInno1	The time from product or service development to offering that product or service for sale is much shorter than our closest competitors	.853	
	ProdInno3	We have a high success rate in new products	.770	
Performance	Performance2	We have a high overall business performance and success	.914	84%
	Performance1	Our Process (Transaction) productivity is high	.914	
Growth	Growth2	Profit growth is high vs competitors	.882	72%
	Growth3	Company market valuation (Stock value) is higher than competitors	.837	
	Growth1	Sales growth is high vs competitors	.829	
Innovative capability	InnoCap2	Our company seeks new ways of doing things	.821	56%
	InnoCap1	Our company frequently tries out new ideas	.778	
	InnoCap3	Our company is frequently the first to market with new products and services	.730	

	InnoCap5	Our new product introduction has increased during the last five years	.669	
Human Capital	HC5	Company devotes a lot of time and effort to update and develops employees knowledge and skills	.861	55%
	HC3	Company employees undergo continuous training programs every year	.818	
	HC1	The competency of the company's employees as a whole is equal to the most ideal level (matching with their work requirements and responsibility)	.692	
	HC2	The company gets the most out of its employees when they cooperate with one another in team tasks	.553	

The Total Variance Explained shows how much of the total variability in all of the items within a scale that can be accounted for by each the construct / factor.

The results for EFA show that the Process Innovation retained one factor. The retained factor explained 53% of variance in the items within the construct. The originally hypothesized construct was the same as the final construct.

The Product Innovation construct retained one factor which explained 70% of variance in the retained items. The originally hypothesized construct was the same as the final construct.

The Performance construct retained one factor with the originally hypothesized items. The retained factor explained 84% of variance in the 2 retained items. Thus, the originally hypothesized construct was the same as the final construct.

Growth retained one factor with the originally hypothesized items. The retained factor explained 72% of variance in the 3 retained items. Thus, the originally hypothesized construct was the same as the final construct.

The Innovative Capabilities construct also retained one factor after removing item InnoCap4, which had a low factor loading. The one factor explained 56% of variance in the items within the construct.

The Human Capital construct retained one factor after removing item HC4, which had a factor loading less than 0.4. The retained factor explained 55% of variance in the 4 retained items.

It can be noted that items within each factor/construct loaded highly on to their respective factors which confirms validity. The factor loadings ranged from 0.542 to 0.914. The factor loading

4.7 RELIABILITY OF SCALE

Cronbach's alpha was computed for each construct or sub-construct. The results are shown in Table 14.

Table 14. 1 Reliability

Construct	Number of Items	Cronbach's Alpha	Level of reliability
Process Innovation	5	.761	Acceptable
Product Innovation	3	.789	Acceptable
Performance	2	.803	Good
Growth	3	.806	Good
Innovative capability	4	.738	Acceptable
Human Capital	4	.722	Acceptable
Entrepreneurial Experience	1	-	-

Entrepreneurial Competency	1	-	-
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The results show that Growth (3 items, $\alpha = 0.806$) and Performance (2 items, $\alpha = 0.803$) had a good reliability level since the Cronbach's alpha values were greater than 0.8. Product Innovation (3 items, $\alpha = 0.789$), Process Innovation (5 items, $\alpha = 0.761$), Innovative Capability (4 items, $\alpha = 0.738$) and Human Capital 4 items, $\alpha = 0.722$) had acceptable level of reliability since the Cronbach's Alpha values were greater than 0.7.

Since all the Cronbach's Alpha values were greater than 0.7, the items within each scale were combined to form a summated scale for the construct. The summated scale was computed by computing the average of the items within the scale. The table 15 summarises the descriptive statistics and Pearson's correlation for all the constructs.

Table 15. 1 Descriptive Statistics and Pearson's Correlation

	Descriptives		Pearson's Correlations							
	M	SD	Process Innovation	Product Innovation	Innovative Capability	Human Capital	Entrepreneurial Experience	Entrepreneurial Competency	Performance	Growth
Process Innovation	3.52	0.77	1							
Product Innovation	3.33	0.79	.673**	1						
Innovative Capability	3.54	0.74	.559**	.499**	1					
Human Capital	3.75	0.66	.482**	.346**	.300**	1				
Entrepreneurial Experience	3.16	0.88	.384**	.345**	.574**	.128	1			

Entrepreneurial Competency	3.62	1.07	.468**	.375**	.507**	.408**	.390**	1		
Performance	3.81	0.80	.495**	.535**	.365**	.520**	.281*	.399**	1	
Growth	3.32	0.79	.357**	.642**	.508**	.317**	.451**	.358**	.582**	1

M – Mean, SD – standard deviation, **. p-value < 0.01, *. p-value < 0.05

The mean values show that Performance (mean = 3.81) was the highest rated construct followed Human Capital (mean = 3.75) and Entrepreneurial Competency (mean = 3.62). The lowest rated construct was Entrepreneurial Experience (mean = 3.16).

There was a significant and positive association between Growth and each of Process Innovation ($r = 0.357$, $p\text{-value} < 0.01$), Product Innovation ($r = 0.642$, $p\text{-value} < 0.01$), Innovative Capability ($r = 0.508$, $p\text{-value} < 0.01$), Human Capital ($r = 0.317$, $p\text{-value} < 0.01$), Entrepreneurial Experience ($r = 0.451$, $p\text{-value} < 0.01$), Entrepreneurial Competency ($r = 0.358$, $p\text{-value} < 0.01$), and Performance ($r = 0.582$, $p\text{-value} < 0.01$) since the p-values were less than 0.05 and the correlation coefficients were positive.

None of the independent variables had very high correlations (>0.8) among themselves. This shows that there is no problem of multicollinearity.

4.8 HYPOTHESIS TESTING

A multiple linear regression model was fitted with Growth as an independent variable and each of Process Innovation, Product Innovation, Entrepreneurial Experience, Entrepreneurial Competency, Innovative Capability as independent variables. The results are shown below.

Table 16. 1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
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1	.726 ^a	.527	.496	.56231
a. Predictors: (Constant), Innovative Capability, Entrepreneurial Competency, Product Innovation, Entrepreneurial Experience, Process Innovation				

The model summary results show that the independent variables Process Innovation, Product Innovation, Entrepreneurial Experience, Entrepreneurial Competency, Innovative Capability could explain 52.7% of growth. This is indicated by an r-square of 0.527. The ANOVA table below shows whether there is a causal relationship between the independent variables and growth.

Table 17. 1 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.790	5	5.358	16.946	.000 ^b
	Residual	24.031	76	.316		
	Total	50.821	81			
a. Dependent Variable: Growth						
b. Predictors: (Constant), Innovative Capability, Entrepreneurial Competency, Product Innovation, Entrepreneurial Experience, Process Innovation						

The F-value of 16.946 and a p-value of 0.000 indicates that at least one of the independent variables is significant in predicting growth since the p-value was less than 0.05. The regression coefficients in Table 15 shows the specific variables that are significant in predicting growth.

Table 18. 1 Regression Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.729	.348		2.093	.040
	Process Innovation	-.315	.120	-.305	-2.626	.010
	Product Innovation	.652	.109	.649	5.958	.000
	Entrepreneur Experience	.178	.088	.198	2.028	.046
	Entrepreneur Competency	.057	.070	.077	.808	.422
	Innovative Capability	.217	.121	.202	1.794	.077
a. Dependent Variable: Growth						

The results shown in Table 15 are the ones that were used to answer the hypotheses.

Results pertaining to hypothesis 1a (H1a): Process innovation has a positive correlation to growth in high technology firm

H0: There is no relationship between process innovation and growth

H1a: Process innovation has a positive correlation to growth in high technology firm

The results shown in the Coefficients table show that there is significant negative relationship between Growth and Process Innovation ($B = -0.315$, $\beta = -0.305$, $t\text{-value} = -2.626$, $p\text{-value} = 0.010$) since the coefficient for Process Innovation was less than zero

and the p-value was less than 0.05. This implies that H1a is not supported. Thus, it is concluded that there is a negative relationship between process innovation and growth.

Results pertaining to hypothesis 1b (H1b): Product innovation has a positive correlation to growth in high technology firm

H0: There is no relationship between product innovation and growth

H1b: Product innovation has a positive correlation to growth in high technology firm

The results shown in the Coefficients table show that there is a significant relationship between Growth and Product Innovation ($B = 0.652$, $\beta = 0.649$, $t\text{-value} = 5.958$, $p\text{-value} = 0.000$). The relationship is positive since the coefficient for Product innovation is positive ($B = 0.652$) and the relationship is significant because the p-value was less than 0.05. This implies that the null hypothesis is rejected in favour of the alternative hypothesis. Thus, H1b is supported. It is concluded that Product innovation has a positive correlation to growth tech firm.

Results pertaining to hypothesis 2a (H2a): Entrepreneurial competency is positively related to growth in high technology firm

H0: There is no relationship between Entrepreneurial competency and growth

H2a: Entrepreneurial competency is positively related to growth in high technology firms

The results shown in the Coefficients table show that there is no significant relationship between Growth and Entrepreneurial competency ($B = 0.057$, $\beta = 0.077$, $t\text{-value} = 0.808$, $p\text{-value} = 0.422$) since the p-value was greater than 0.05. This implies that H2a is not supported. Thus, the null hypothesis is not rejected and it is concluded that there is no significant relationship between Entrepreneurial competency and growth.

Results pertaining to hypothesis 2b (H2b): Entrepreneurial experience has a positive correlation to growth in high technology firm

H0: There is no relationship between Entrepreneurial experience and growth

H1b: Entrepreneurial experience is positively related to growth in high technology firms

The results shown in the Coefficients table show that there is a significant relationship between Growth and Entrepreneurial experience ($B = 0.178$, $\beta = 0.198$, $t\text{-value} = 2.028$, $p\text{-value} = 0.046$). The relationship is positive since the coefficient for Entrepreneurial experience is positive ($B = 0.178$) and the relationship is significant because the $p\text{-value}$ was less than 0.05. This implies that the null hypothesis is rejected in favour of the alternative hypothesis. Thus, H2b is supported. It is concluded that Entrepreneurial experience has a positive correlation to growth in high technology firm.

The results are shown and are presented in table 16;

Table 19. 1 Performance mediating relationship between Process Innovation and Growth

	Model 1: Process Innovation > Growth			Model 2: Process Innovation + Performance > Growth			Model 3: Process Innovation > Performance		
Blank	B	SE	β	B	SE	β	B	SE	β
Intercept	2.024***	.389		0.954***	.398		2.001***	.363	
Process Innovation	.368***	.108	.357	.094	.108	.091	.514***	.101	.495
Performance				.535***	.104	.537			
F	11.663***			20.809***			25.990***		
R ²	.127			.345			.245		
Adj R ²	.116			.328			.236		
Notes for parameters: B = unstandardized parameters, β = standardized parameters, *** = $p < .01$, ** = $p < .05$, * = $p < .10$.									

The results for model 1 show that there is a significant relationship between Growth and Process Innovation ($B = 0.368^{***}$, $\beta = 0.357$, $p\text{-value} < 0.01$). The model shows that variation in Process Innovation explains 12.7% of variation in Growth.

From model 1, since the p -value for Process Innovation is less than 0.05 and the coefficient of Process Innovation is positive it is concluded that there is a significant and positive relationship between Process Innovation and Growth. The significant relationship between Process Innovation and Growth in model 1 satisfies condition 1.

Model 3 shows that Process Innovation ($B = 0.514$, $\beta = 0.495$, $p\text{-value} < 0.01$) is significant in predicting Performance since the p -value is less than 0.05. Thus, condition 2 is met.

Model 2 shows that the model with the independent variable and mediator variable was significant ($F = 20.809$, $p\text{-value} < 0.01$), thus condition 3 is met. It can also be noted that on model 2, the introduction of the mediator variable, Performance, led to a decline in the change in coefficient of Process Innovation from 0.368 to 0.094. This satisfies condition 4. Thus, it can be concluded that the relationship between Process Innovation and Growth is mediated by Performance.

The Sobel test was conducted to test whether the mediator variable (Performance) carries the influence of an independent variable (Process Innovation) to the dependent variable (Growth).

Table 20. 1 Sobel test for effect of mediator variable

Test Statistic	SE	P-value
3.991	0.075	0.000

The results for the Sobel test (test statistic = 3.991, $p\text{-value} = 0.000$) shows that the indirect effect of the Process innovation on Growth through performance is significantly different from zero since the p -value was less than 0.05. It is therefore concluded that Information Technology infrastructure flexibility (ITIF) enhances operational performance which is positively related to growth firms.

Table 21. 1 Summary of hypotheses

Hypothesis		Outcome
Ha1	Process innovation has a positive correlation to growth in high technology firm	Not Supported
H1b	Product innovation has a positive correlation to growth in high technology firm	Supported
H2a	Entrepreneurial competency is positively related to growth in high technology firms	Not Supported
H2b	Entrepreneurial experience has a positive correlation to growth in high technology firm	Supported
P1	Information Technology infrastructure flexibility (ITIF) enhances operational performance which is positively related to growth in high technology firm	Supported

4.9 CONCLUSION

The results revealed supported hypotheses and to our surprise, some were rejected, which was an interesting outcome. Product innovation, Entrepreneurial experience were validated by the respondents as a supporting construct for growth in high technology technology firms. Process innovation, as well as Entrepreneurial competency, was rejected as revealed in the research. CHAPTER FIVE: DISCUSSION

4.10 INTRODUCTION

This segment of the investigation report deliberates on the results and explains the findings thereof in tandem with the literature review. It is fundamental to interrogate findings of this study in relation to previous studies conducted with similar objectives, whether hypotheses are rejected or accepted. The main concern of the study has to do with understanding the relationship aspects between IT infrastructure flexibility in relation to the growth of high technology enterprises in South Africa.

4.11 DEMOGRAPHIC PROFILE OF RESPONDENTS

The results displayed in Chapter 4 demonstrated that the sample comprised 60% male respondents while females had a 40% representation. This translates to 57 males and 38 females respectively. The distribution of the respondents is similar to what the researcher was expecting, as several publications, including the World Bank Research Observer (2010) have alluded to the fact that there are a higher number of males in high information technology / sciences sector compared to women..

4.12 DISCUSSION OF HYPOTHESES

4.12.1 H1a Process Innovation Has a Positive Correlation to Growth in high Technology Firm

The findings of the study found no significant relationship between the constructs, thus rejected the hypothesis. In earlier studies, Ettlie and Reza (1992) found that in South East Asian economies, a contemporary organizational hierarchy, improved coordination between design and manufacturing, and contractor relations supported the prosperity of process innovation. In addition, the authors found that implementing market centred integration mechanisms such as fostering consumer agreements, constructively affected intra-process flexibility.

The GEM Report (2015) is a credible source of information by which to gauge the entrepreneurial context framework of different countries. The report highlighted the fact that, with the exception of Morocco, South Africa is the only efficiency-based economy. This means that the country depends on advanced automation and the generation of goods of superior quality to be able to compete in a globalised economy. One of the pivotal results of the GEM Report was that respondents demonstrated depressed perceptions of opportunities, capabilities and intentions in South Africa, as compared to the factor driven economies (which essentially has less economic potential). Such an observation is a plausible reason for why the hypothesis was rejected. This reflection is particularly worrisome because it implies that most local entrepreneurs in the economy perceive more challenges than prospects in the local process innovation landscape, and

thus, ultimately, survival will be of more importance than investing in new processes. Furthermore, process innovation could be a poor conduit for growth in high technology firms since it is tedious and costly for firms to gain technological utility because of limited protection from competitive replication and full process evasion.

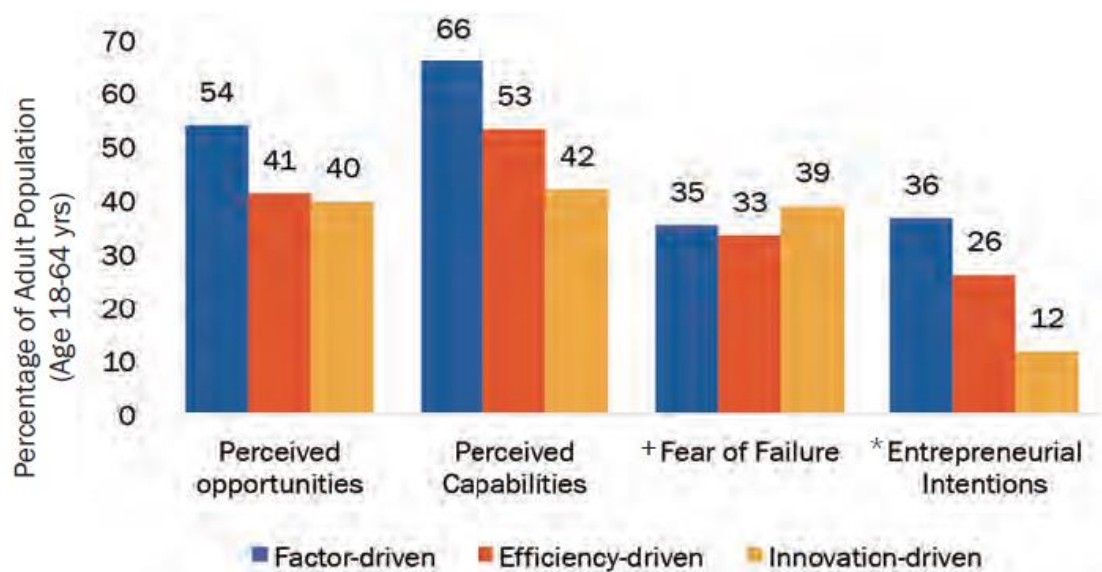


Figure 4: Development Group Averages for Self-perceptions about entrepreneurship in 60 Economies

Source: GEM Report 2015/16

It also important to recall that with South Africa's inheritance of protectionist policies from the apartheid era, the development and adoption of policies that epitomised competition proved lethargic at best (Green, 2009). Findings that process innovation may not necessarily lead to growth in high technology firms may also be attributed to the country's stalled competitiveness rate, which is 54th overall globally, between 2009 and 2011. Furthermore, Davenport (2013) said research on process innovation was inconsistent because it was highly context specific. For instance, the fact that the country has a high labour inflexibility that manifests in rigid employment and dismissal practices and the tertiary enrolment rate (15% - thereby relegating the country to the 99th position

worldwide for that specific indicator), must be considered. The prevailing consequence is the fact that poor tertiary education undermines the country's latent power in terms of novelty in innovation, let alone its revolutionary procedures (Global Competitiveness Report, 2011).

The Global Innovation Index has also emphasized the influence of innovation of different nations and by extension, this outcome has accentuated the discrepancies of the region's innovativeness and strategies for competitiveness. For one, it has shone the light on emphasis and support (or lack thereof) extended to primary areas of competitive excellence within industries (Cadil, 2012). These areas ought to be realms of domination that can be categorised as trade and industry activities with substantial embeddedness in the commercial terrain of the labour market and industry expertise (McCann & Ortega-Argiles, 2015). Worth noting is that the establishment of business domains requires economic streamlining, as well as altering the dynamics and fraction of domination territories like process innovation. The European Commission (2012) developed principles for 'smart specialisation' that pinpointed four rudimentary categories of reorganisation:

- transition (migration from one level to another),
- modernisation (contemporary advancements in that area of specialty),
- diversification (creation of novel specialties),
- and the realization of new technological spheres is seen to be the highest degree of restructuring.

To conclude on this matter, the rationale suggested by Cooke (1996) of "islands of innovation" and the "networking paradigm" seem relevant as a perspective and context why the hypothesis was rejected. The former communicates the idea that innovations often cluster in specific spatial areas or regions. The latter refers to an analytical framework of gaining idiosyncrasies based on the strength of innovation networks. Overall, the ability to harness process innovation in high technology requires the knowledge workers to assimilate eccentric mental networks with unique problem-solving skills and thinking style preferences (e.g., logical, verbal, visual) to foster the creative flow (Gardner 2011; Gladwell 2008). Cooke summarised pro-innovation attributes as the

following four I's: identification, intelligence, institutions and integration. These qualities are agreed to be a basis for competitive benefit of the region or country.

4.12.2 H1b: Product innovation has a positive correlation to growth in high technology firm

This finding was supported in this research. Coad and Rao (2008) found that product innovation compelled small high technology firms to migrate from a technically inclined philosophy to a market-led viewpoint; as a result, such a tactical awareness from what was previously assumed to be otherwise 'oblivious technocrats' caused firm growth and sustainability. South Africa's surge in output is directly linked to its overseas capital utilisation by indigenous businesses. Furthermore, Van Stel *et al.* (2003) said product innovation aligned itself to the concept of creative accumulation. According to Cefis and Orsenigo (2001), creative accumulation is when reputable companies focus on R&D activities as a basis for competitive advantage, and thus determine a steady rate of innovation as a result of a concentrated market structure. In fact, innovation is on the basis of amassed progress and conventional proficiencies rather than ground-breaking principles. As discovered by Edwards (2001), the argument of this study is bolstered by the fact that South Africa's greatest and most consistent industry output is often seen in the subdivisions of agribusiness, metal and its by-products, machinery, and transport equipment, construction and infrastructure development and conveyance services.

4.12.3 H2a: Entrepreneurial competency is positively related to growth in high technology firms

This hypothesis was proven false, because of the minimal relation between constructs.

Authors have varied findings when it comes to the role of entrepreneurial competence in relation to firm growth in high technological industries. The biggest critique of entrepreneurial competence that may provide plausible reasons why the hypothesis was rejected is how competence is dependent on the nature of available opportunities. For instance, Muzychenko (2008) argued that while the entrepreneur may be competent in a certain field, at that specific time, the opportunities to demonstrate one's proficiency may not necessarily be available in that instance, thereby hindering growth spurts.

Obschonka, *et al.* (2010) on the other hand, found that primary commercial aptitude in one's youth was positively related to the venture creation process. He added that the early onset of entrepreneurial competence anticipated prowess in serial entrepreneurship ventures revealed in one's subsequent working life. Such findings emphasised the overlooked importance of early business competence for organizational performance.

Dermol and Cater (2013) decried the fact that entrepreneurial competency in individuals is not a trait they were intentionally aware they possessed and as such, the opportunity costs in businesses were higher, due to missed prospects. This seems to suggest that from a firm perspective, emphasis needs to be made on intrinsically motivated staff and the requisite resources committed, as such employees intentionally develop creativity enhancing habits and resilience to achieve breakthroughs (Schaffer, Chastagner and Umesh, 2016). Another reason for a failed hypothesis is the lack of clarity surrounding the concept of competence in its application (Lans, *et al.*, 2008) and as such, the exact attributes of competency- accomplishments, responsibilities, aptitudes, and individual characteristics are sketchy. Moreover, such a finding may bear witness to the argument that the managerial expectations of entrepreneurial competence are more behavioural, while experience is managing crucial matters of internal communications, resource allocations and inefficiencies in real time. As such, the demands of managerial quality and business performance are less pronounced.

4.12.4 H2b: Entrepreneurial experience has a positive correlation to growth in high technology firms

In the case of entrepreneurial experience as a positive attribute for growth in high technology firms, this study also supported that hypothesis. In Erikson's work (2003), the author found that the pivotal threshold in entrepreneurship was the nascency stage, as it separates beginners from serial entrepreneurs. This nascent stage is operationalised by the GEM database as the percentage of individuals who are actively involved in initiating a business and have not paid salaries for three months and as a result, that remains one of the most basic challenges to which the entrepreneur must rise. While this stage may seem inferior, the author's work proved that this created a chasm of distance between that primary stage of entrepreneurship and intentional entrepreneurs. More examples of scholarly work, such as studies conducted by Zaleski (2011), found that the role of

entrepreneurial experience was critical in attracting external equity within the first year as a start-up, and it was often a good determinant for whether an enterprise would remain in business. Therefore, in the same vein, experienced entrepreneurs are found to be more tenacious in amassing entrepreneurial financing and rationalising it to the level of business growth. Contrary to previous studies, Odirici and Pressutti (2013) found that habitual entrepreneurs were more adept in partaking in risky business behaviour that is often activated by a highly active learning orientation. Venkataraman, Sarasvathy, Dew and Forster (2012) realised that exposure to prior knowledge increased an entrepreneur's edge in recognising abstract events as ideal opportunities to renew the organisation and thus, contribute to its growth. Several authors stated that such prior knowledge comes in the form of the entrepreneurs' awareness of, or intelligence regarding, the environment, competitors, industry constraints, technology, and consumer patronage (Hisrich, Langan-Fox, & Grant, 2007; Tang, Kacmar, & Busenitz, 2012).

4.12.5 P1: Information Technology infrastructure flexibility (ITIF) will enhance operational performance which is positively related to growth in high technology firm

The hypothesis as put forth, received positive support, although it is noteworthy to point out that there is limited research on IT flexibility investment in relation to operational performance as an antecedent to firm growth. One of the initial studies from Venkataraman and Zaheer (1994) found that the connected agents in an electronic integration experiment in the insurance industry outdid independent ones who were based in a different area. Business Model Innovation (BMI) is an emergent field of study that suggests that with a constructive value proposition and the support of IT flexibility in its configurations (Bouncken & Fredrich, 2016), firm growth could be realised. Other authors have said BMI is not sufficient to realise, as competitive strategy was necessary to encourage a solid value proposition. Although the sources are not exhaustive, a handful of researchers have found BMI is positively correlated to a firm's performance (Giesen *et al.*, 2010; Huang *et al.*, 2013). While these studies carried an indication that operational performance increased because of information technology flexibility, in general, such feats were not extensive. That as the case may be, a solid conjectural argument can be suggested that the mere existence of infrastructure flexibility in

technological industries creates a dominant enticement for transnational expansion as a windbreak against local country threats. For instance, an organization with several intercontinental plants could swiftly exploit their resources and positioning and avoid unpredictable exchange rates and labor markets by transferring production back and forth between plants situated in different countries. Moreover, one should acknowledge that while former readings have found minimal substantiation of a linkage between ICT and growth, further current studies demonstrate a constructive consequence of ICT outlay on growth (Oliner & Sichel, 2000; Timmer & Van Ark, 2005; Van Ark *et al.*, 2008).

In addition, these studies could not distinguish between technology changes and business process changes as causes for any observed performance differences. Implementation of an information technology typically is accompanied by changes to some group of business processes.

4.13 CONCLUSION

Revolutionary improvements in technology are altering the globe and the influence of technologically astute businesses is largely recognized as constructive (den Hertog, van der Aa & de Jong, 2010; Hausman & Johnston, 2014). The creation of high technology businesses is perceived as a progressive stride for regional wealth generation (Kraftova, Prasilova & Mateja, 2011). The separation between “high technology” and “knowledge-intensive” businesses, where R&D proficiencies prevail and other “established” industrial enterprises is evident in academic literature (Pisano, 1997). Although the study of IT infrastructure flexibility is fragmented and at elementary stages, the positive hypothesis found in that regard is noteworthy, especially since the interaction between a service facility and production results can be enhanced through sustainable firm performance (Kastalli *et al.*, 2016). Further worthiness of the subject is reinforced in the sentiments (Zainon and Salleh, 2016) that Information Technology Infrastructure flexibility is an organizational competency essential for organizational performance for a dynamic business environment as there is currently. This is especially true as many firms in developed countries will in the future no longer see their facilities as inactive immovable resources, but rather as detached workshops that can be extended, disassembled, or repositioned according to the dictates of the competition in the environment.

5 CHAPTER SIX: CONCLUSION

5.1 INTRODUCTION

This paper is structured in a format where the first chapter began with exploring the performance of high technology organisation and their ability to achieve growth. Companies employ various technologies to their products, production and processes in order to attain and sustain competitive advantage. This researcher looked at Information Technology infrastructure flexibility of South Africa, as well as the human capital in high technology firms and this paper looked into those constructs locally. The second chapter is the literature review segment which took care of an in-depth discussion on the major constructs investigated in this study; process innovation, product innovation, entrepreneurial competency, entrepreneurial experience and the proposition of Information Technology infrastructure flexibility and what effects these have on growth organisations. The following chapters was chapter 3, dealing with methodology, followed by chapter 4, which presented research results. The results were discussed in chapter 5 and what constructs were proven or not supported and what this meant. The final chapter deals with the implications of the study relating to the constructs and recommendations and further research are proposed.

5.2 SUMMARY OF LITERATURE

This chapter discussed the merits of IT infrastructure flexibility as a mediating influence on innovative capability, human capital and the growth of high technology firms in the Gauteng province. Policymakers, technology entrepreneurs or ‘technopreneurs’ and academics have considered the formulation of high capability firms in high technology industries as a panacea for economic growth. It should be noted that due to the very nature of high technology, its definition continually shifts; the high technology of the present will be traditional technology in the future if it still endures. The swiftness at which technological variation take place establishes a challenge in the measuring of this phenomenon as the field of study may vary from one instant to the next (Villamizar, Cobo and Rocha, 2017).

The literature section reviewed how the human capital theory and innovative capability as independent variables contribute to growth in high technology enterprises. Infrastructure flexibility as a mediating variable will embed flexibility as a fundamental growth reinforcement for high technology firms in Gauteng. Successful entrepreneurial firms have extensively credited their economic prowess to attributes of human capital (Florin *et al*, 2005; Unger *et al*, 2009). Chen and Li (2003) defined it as exclusive, idiosyncratic firm investments in terms of talent and technologies for competitive advantage. Entrepreneurial competencies (ECs) are categorised as a precise cluster of proficiencies that are essential to be executed for prosperous free enterprise. Fleury and Fleury (2001) defined competency as a predictable experience on how to perform; which suggests marshalling, incorporating, transmitting information, talents and resources which strengthen financial worth to the organization and shared value to the entrepreneur. Entrepreneurial experience is an invaluable asset because it provides a source of direct learning and episodic knowledge. Politis (2008) said individuals who were experienced in business offered tangible understanding of evolving organisations, harnessing resources and skills, and labour, and are familiar with the exploitation of established and active social linkages. Vinding (2006) supposed human capital has an intimate relationship with innovative ability, whereby an organisation's ability in approaching and unearthing new influences in new knowledge is seen and displayed. Human capital also plays a major role in productivity growth. Among high technology manufacturers, new innovative products that were developed as a result of Research and Development (R&D) and technical acumen had the greatest impact on revenue growth when knowledge assets were high. The argument warrants a discussion on innovative capability as a conduit for novel innovative products and the enhancement of technology for growth firms. Innovation requires the firm to have competences in terms of technological prowess and customer relations and each of these competences represented a set of growth-inducing resources. According to Tong (2005), technological opportunities are not evenly distributed across various industries, and thus Research and Development often became a focal point of opportunities and efforts. One of the fundamental characteristics of modern business is the rapidly changing environment. Information Technology (IT) infrastructure flexibility is an enabling foundation for business applications and it may support innovation in business processes. Moreover, firm growth is the gateway to the introduction of innovations and technical change in a

business seeking competitive gains in order to face the market from a better position (Pagano & Schivardi, 2003). The literature confirmed that innovative capability enhances the valuation of a firm because it affects the internal technical competencies on opportunity recognition and competitiveness.

5.3 SUMMARY OF RESULTS

This section considers the presentation as well as the descriptions of the results. The results give reasons as to what the high technology industry perceives as contributors to growth technology firms within Gauteng, focusing on Johannesburg. The researcher presented the findings of the constructs that were explored in the paper. The results revealed supported hypotheses and to our surprise, some were rejected, and of those further research is necessary to gain insight. Product innovation, Entrepreneurial experience were supported by the respondents as a supporting construct for growth in high technology firms. Process innovation as well as Entrepreneurial competency was rejected as revealed in the research.

5.4 LIMITATIONS

- Homogenous data set in terms of one nationality, a broader perspective may have been availed to the researcher if research was conducted with a continental counterpart (Morocco) as the other African country graded as an efficiency-driven economy.
- Poor delineation of IT Infrastructure Flexibility constraints and/ or ancillary and opportunities and further challenges per industry e.g. pharmaceutical or automotive industry alone, as this study is a cross sectional research. Such delineation would examine the emphasis placed on the growth urgencies in industry
- Research is quantitative in nature and therefore mutes the 'voices and personal experiences' of respondents currently employed within the high technology sector, which may limit the range of recommendations and/or insights to be gained for further work.

- A longitudinal study would provide insight in terms of national policy implications in high technology sector and how the resourcing/sector performance framework has evolved within those years

5.5 IMPLICATIONS AND RECOMMENDATIONS

5.5.1 Process Innovation

The results indicate that more than 60% of the respondents either agreed or strongly agreed with statements Proclnno1, Proclnno2 and Proclnno3. Process innovation plays an important role in meeting excellent customer service. Although, in this study the hypothesis was rejected, it is a theoretical argument that process innovation is an idiosyncratic resource that will have positive benefits. These include increase in sales, return on assets, and overall improved financial analysis.

5.5.2 Product Innovation

While the hypothesis was positive, and all items were met with positive reception, the least agreed with is an item: with Prodlnno1 where 32% indicated that they either “agree” or “strongly agree” with the statement: “The time from product or service development to offering that productive or service is much shorter than our closest competitor”. This finding suggests that most respondents have noted that their production timelines to market are slow and could be improved. As a result business strategy could be suffering. It is recommended that the organizations invest in business intelligence software to address the time lag between data acquisition and decision making, therefore causing delays in releasing products to market and meeting customer demands.

5.5.3 Entrepreneurial competency

Entrepreneurial competency is one of the constructs whose hypothesis was not supported. The competency approach to study entrepreneurial characteristics can be a bit challenging, especially because the development of the instrument has been

recorded to be challenging. A range of instruments measuring this construct focuses on traits, skills, experience and knowledge and tend to be behavioural in nature. The researcher recommended that there be distinguishing of the roles of different competencies on firm performance, to encourage a more focused approach in providing training to entrepreneurs.

5.5.4 Entrepreneurial Experience

A proportion of 31% indicated that they either “agree” or “strongly agree” with the Entrepreneurial Experience item (Entre_Exp). The hypothesis was supported, which was anticipated. Other authors predicted that experience regulates performance in general (Hultman, Katsikeas, and Robson 2011) and as such familiarity bred further knowledge (Griffith, Yalcinkaya, and Rubera 2014). As interested parties in the innovation performance, individuals gain know-how by producing and safeguarding technology, and commercializing the technology, they acquire more expertise, and this allows them to better appreciate the possible prospects for further learning.

5.5.5 Information technology infrastructure flexibility

The hypothesis put forth received positive support, although it is noteworthy to point out that there is limited research on firms investing in IT infrastructure flexibility in relation to operational performance as a contributor to firm growth. As Bhatt (2010) discovered, infrastructure flexibility led to information generation and information dissemination. Above that, the latter was responsible for organizational responsiveness. The direct implication is that it leads to competitive advantage. An area that needs to be reinforced, is that of managerial quality in terms of leadership to implement IT infrastructure flexibility. It is interesting to note that there is minimal literature on this subject, but of the papers available the sample is managers, as those strategically positioned to push the agenda to the betterment of the organization. It is recommended that management facilitates the configurational flexibility to ensure customer needs are met quickly.

5.5.6 Human capital

It was not surprising that the hypothesis was supported. Knowledge-intensive companies operate because of the wealth of human capital at their disposal. They serve as sources of innovation process development or deliver services and carriers of innovation when they participate in technology-transfer activities. It is recommended that for effective exchange of competencies, skills and knowledge to occur, persons must (1) have access to individuals or groups with specialized information; (2) be able to absorb and harness information that has been exchanged.

5.6 SUGGESTIONS FOR FURTHER RESEARCH

As high technology has been touted as the engine for 'stimulating the comprehensive competitiveness of nations' it would be interesting to investigate South Africa's Internationalization-Innovation Profile (IIP), taking into consideration its high technology patent profile and how resources (human, physical organizational capital) and have been deployed for commercialization. Furthermore, an investigation or review of national Technology Balance of Payments (TBP) in the last 10-15 years. This framework mirrors a nation's lucrative dealings connected to international high technology and expertise transfers. It also involves investments made or received for the utilization of patents, expertise, trademarks, designs and technical services. The effect and/or role of policy experimentation on the country's National Innovation System (NIS) to increase international competitiveness is worth exploring.

5.7 CONCLUSION

Research into the consideration of areas such as high technology and IT Infrastructure Inflexibility in the local context, as an innovative capability is worth the discussion. It goes without saying that the funding requirements for high technology can be very high. Fiscal performance in the country remained subdued, reporting a mere 1.3 % growth. This lethargic growth was principally caused by low global commodity prices, poor investment security, and inconsistent flows of capital, as well as business confidence (African Economic Outlook, 2016). Amidst other challenges that the country has

encountered, relative productivity and moderate growth has been witnessed; unfortunately, the phenomenon of 'jobless growth' is also gaining momentum. Kinyondo and Mabugu (2009) defined jobless growth as a condition where the productivity grows while the number of people with jobs is not growing at the same rate. The Labour Force Survey (2005) reported that the unemployment rate was 37.1% and 22.6% for men and women respectively. The unemployment rate recorded by Statistics SA was recorded at 25.2 % in January 2016 and at 26.5% in January 2017.

The government's stance vis-à-vis the high-technology sector—and the whole South African economy is at a precarious stage. As promising as the industry is, trepidations exist about its sustainability in consideration of its current challenges and a weakening of the structural constituents reinforcing its success (Berry and Grayeff, 2009). For novel technological ideologies to extensively affect a country's growth, a stable political system and financial markets, as well as a robust education system that is directly responsive to the demands of the globalised world, are imperative (Alfaro, 2010). The results however, have enhanced other arguments, one matter that comes to mind, is that of human capital in specific relation to entrepreneurial experience. The discussion on whether human capital nurtures commercial advancement, especially the growth of ICT-intensive industries, is stimulating and appropriate for both research and policy. All the same, an entrenched theoretical literature showing the positive effects of human capital on economic growth, the existing empirical evidence is mixed. Further work is necessary to address entrepreneurial constraints and those of incumbent firms in the propagation of creative destruction in the local landscape.

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APPENDIX A

The influence of infrastructure flexibility on the relationship between innovative capability, human capital and growth: A study of high technology business in Gauteng

Dear Sir/Madam,

My name is Neo Mothopeng and I am Master's student at the Wits Business School under the Faculty of Commerce, Law and Management. University of the Witwatersrand, Johannesburg. The title of my research is: **The influence of infrastructure flexibility on the relationship between innovative capability, human capital and growth: A study of high technology business in Gauteng.** Specifically, I want to investigate the extent to which infrastructure inflexibility, as a mediating variable affects the perceived innovative capability, human capital and growth within high technology firms

As an employee in one of the Gauteng firms within the high technology domain you are invited to participate in my research by completing the attached questionnaire. The purpose of the questionnaire is to investigate how your different values help you gain access to different resources as well as impact the performance of your business.

The questionnaire is broken down into eight parts. In part 1 and part 2, you will be asked questions about you and your business. In part 3, you will be asked questions relating to infrastructure flexibility. In part 4, you'll be asked about innovative capability with regard to the product and process innovation. In part 4, you'll be asked questions relating to how you run your business. In part 5, you'll be asked questions relating to entrepreneurial competency in the organisation and part 6 will be about performance/growth. There are 40 questions in total and the questionnaire should take about 20 minutes to complete.

What will happen if you choose to participate in the research?

- There is no risk to you and no harm will come to you if you do participate
- My research assistant will ask you to sign a consent form. By so doing, you agree to participate in the research. Before signing the form, please make sure that she has answered any questions you might have about the research.
- Your responses are important and there are no right or wrong answers. It would be appreciated if you answered all the questions. However, you may choose not to answer certain questions and you may stop answering the questionnaire at any stage.
- Your responses will be taken to be both confidential and anonymous. In order to ensure your confidentiality and anonymity, you will not be required to give your name or your business's name at any stage.
- Should you struggle to understand any of the questions, my research assistant will assist by translating them into a language you are comfortable with.
- This study is for academic purposes only. The results of the study will only be reported in my thesis as well as in journal articles, and your responses will not be shared with anyone else. Questionnaires will be kept for a period of 5 years in my office to facilitate further research, and will be destroyed thereafter.

What will happen if you choose not to participate in the research?

- Participation in the research is purely voluntary. Nobody will force you to complete the questionnaire.
- There will be no penalty or consequence if you do not complete the questionnaire.

The study was approved unconditionally by the Human Research Ethics Committee (non-medical) of the University of the Witwatersrand, Johannesburg. Should you have any queries relating to the research, please feel free to contact me on 073 325 9850 or lnmothopeng@gmail.com. Alternatively, you can contact my supervisor Dr Robert Venter 084 580 7587 or robert.venter@wits.ac.za. You may additionally direct any requests for copies of the results to me on the aforementioned numbers.

COVER LETTER AND QUESTIONNAIRE

1) What is your Gender?

Male

Female

2) Position of the person who completed this questionnaire: _____

Yes _____ No _____

3) Primary Business Areas – Please tick one:

_____ Financial _____ health services _____ manufacturing _____ retail

_____ Real estate _____ government _____ wholesale _____ banking

_____ Insurance _____ mining _____ transportation _____ education

_____ Communications _____ construction _____ other (please specify)

4) In which year was the business-established _____

5) How many locations does this business have ? In home country

_____ Locations/Overseas _____ Locations

INFRASTRUCTURE FLEXIBILITY

1) Strongly Disagree 2) Disagree 3) Neither Disagree nor agree 4) Agree 5) Strongly Agree

6	C1 customers' requests for customized Products					
7	C2 We enjoy an agile, flexible organizational structure that enables us to produce customized products very rapidly					
8	C3 Our organization is able to deliver a wide variety of products to special customer Orders					
9	C4 The time from product or service development to offering that product or service for sale is much shorter than our closest competitors					
10	C5 Concurrent engineering (e.g., simultaneously considering design, manufacture, and marketing of new products) is used much more in our organization than in those of our competitors					
11	C6 The lead time to bring new products or services to the market is much shorter in our organization than those in our competitors					

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Company's Performance

1) Strongly Disagree 2) Disagree 3) Neither Disagree nor agree 4) Agree 5) Strongly Agree

12	Industry Leadership					
13	Success rate in new products					
14	Overall business performance and success					
15	Process (Transaction) productivity					
16	Sales growth					
17	Profit growth					
18	Company market valuation (Stock value)					

Innovative capabilities Scale

1) Strongly Disagree 2) Disagree 3) Neither Disagree nor agree 4) Agree 5) Strongly Agree

19	Our company frequently tires out new idea					
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	Our organization can quickly respond to					
20	Our company seeks new ways of doing things					
21	Our company is frequently the first to market new products and services					
22	Innovation is perceived as too risky in our company and is resisted (reversed coded)					
23	Our new product introduction has increased during the last five years					
24	Large numbers of new products are launched compared with competitors					
25	Company employees are continuously encouraged to bring new knowledge and ideas to the business and share their knowledge with their colleagues					

Human capital Scale

1) Strongly Disagree 2) Disagree 3) Neither Disagree nor agree 4) Agree 5) Strongly Agree

26	The competency of the company's employees as a whole is equal to the most ideal level (matching with their work requirements and responsibility)					
27	The company gets the most out of its employees when they cooperate with one another in team tasks					
28	Company employees undergo continuous training programs every year					
29	The ratio of educated personnel is on average compared with industry) no. PhD, Masters and Bachelor degrees compared with what should be).					
30	Company devotes a lot of time and effort to update and develops employees knowledge and skills					

***** END *****

Thank you for giving of your time in participating in this study. Your input is appreciated and will be treated as confidential at all times.