

Outcomes of SMMEs Participation in Incubator Programmes in South Africa

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I would like to acknowledge and thank my family and friends who have helped and encouraged me during the process of completing this dissertation.

To my grandparents, you were there at the start of this journey, but you won't get to see me graduate. This is dedicated to you. Your love and support meant the world to me. You are missed and loved.

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Abstract

South Africa's small, micro and medium enterprise (SMME) sector is an important contributor to GDP and employment. However, the contributions underperform the average low-income and middle-income country. The government has plans to increase SMME GDP and employment contributions. To do this, the Department of Small Business Development was recently established, and together with other agencies, several business incubators have been established. The number of incubators operating in the country has increased significantly in the recent past. There is a belief that incubators are organisations that will help SMMEs perform better and improve their chances of survival. To improve employment and GDP growth, SMMEs need to perform better and survive longer. However, there is limited evidence to confirm this understanding. This research aims to fill this gap of knowledge by investigating whether firms that participate in incubators have improved revenue, employment and financing performance, which improves survival prospects. The ordinary least squares estimation techniques was employed to estimate a cross sectional model to examine the effect of incubator participation on the performance of 182 SMMEs. The performance measures used included revenue, employment, and external equity, debt and philanthropic finance.

The findings in the study from the cross-sectional analysis showed there was no selection bias and endogeneity evident. Firms with better performing dependent variables (revenue, employment and external financing) were no more likely to be selected to be incubated. Following this, the study found that firms that participated in incubators did not have a statistically significant different level of revenue, number of employees or external equity and debt financing, compared to firms that did not participate in incubators. The findings from the study indicated that increased participation in incubators did not guarantee increased revenue, employment and external equity and debt financing. The findings indicated that there was a possibility that incubated firms could raise more philanthropic financing than non-incubated firms. The policy recommendations from these finding are, therefore, to minimise the resources provided to incubators as they do not improve SMME performance. Resources should be provided to other SMME interventions such as providing growth capital directly to these firms.

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List of Abbreviations

ANOVA	Analysis of variation
CEO	Chief Executive Officer
DTI	Department of Trade and Industry
EDP	Entrepreneurship Database Programme
GALI	Global Accelerator Learning Initiative
IMF	International Monetary Fund
IP	Intellectual Property
NIY	Finnish acronym for “young innovative growth companies”
NTBF	New Technology Based Firm
OECD	Organisation for Economic Co-operation and Development
PhD	Doctor of Philosophy
SBIR	Small Business Innovation Research
SEDA	Small Enterprise Development Agency
SMME	Small Micro Medium Enterprise
STP	SEDA Technology Programme
TIPS	Trade & Industrial Policy Strategies
USD	United States of America Dollars
UTBI	University Technology Business Incubator
VIF	Variance Inflation Factors
ZAR	South African Rand

Chapter 1: Introduction

1.1 Background of the study

The South African economy is in a precarious predicament. In late 2019, expectations were that Gross Domestic Product (GDP) would grow by 0.5% in 2019 which was significantly lower from the 1.5% proposed earlier in the year (National Treasury, 2019). The weak economic growth negatively impacted the unemployment rate, which in the third quarter of 2019 was at its highest level since 1994 at 29.1% (Statistics South Africa, 2019). Weak economic growth resulted in reduced tax revenues while, at the same time, government expenditure increased. This weakened the South African fiscal position, increased the country's borrowing requirements and threatened the sustainability of the government's finances (IMF, 2019). Adding to this bleak outlook, the International Monetary Fund, IMF (2019), projected that weak economic growth would continue, increasing the unemployment rate, and exacerbating poverty and inequality.

The prospect of increasing poverty is concerning, as close to 50% of adults were living below the upper bound poverty line in 2015 (Statistics South Africa, 2018). In addition to widespread poverty, South Africa is already the most unequal society in the world (The World Bank, 2018a). High levels of unemployment and poverty and significant income inequality means that many citizens have low standards of living. To improve the quality of life of her people, the South African Government needs to urgently address these challenges.

National Treasury (2019) articulated that long-term economic growth is required to reduce inequality, lower unemployment and eliminate poverty. Reducing inequality, lowering unemployment and eliminating poverty are the goals of the National Development Plan (NDP) and the UN Sustainable Development Goals (UN SDGs). The government, however, has limited ability to increase government spending to kick-start economic growth. This is due to the country's weak fiscal position. Government spending now has to be smarter in identifying interventions that will significantly improve long-term economic growth prospects with limited actual spending.

The National Planning Commission (2012) developed the NDP which provides a plan to reduce inequality and to eliminate poverty and high levels of unemployment by 2030. To accomplish this vision, the South African economy has to transform and grow faster.

As a means to overcome the high level of unemployment, the NDP wants 90% of new jobs to be created by small, micro and medium enterprises (SMMEs) by 2030 (The World Bank, 2018a). According to The World Bank (2018b), SMMEs are also important in reducing inequalities and helping young people enter the labour market. In South Africa, the share of employment from SMMEs accounted for 67% of employment in 2015 (The World Bank, 2018c). This share of employment is disappointing compared to low and middle-income countries where SMMEs contribute more than 70% and 95% of employment, respectively (Ayyagari et al. as cited by The World Bank, 2018a). SMMEs also survive, or operate for longer periods in the Organisation for Economic Co-operation and Development (OECD) group of countries, which is a group of developed economies, when compared to South African SMMEs. TIPS (2017a) highlighted research that shows that 20% of South African SMMEs survive for more than three years, whereas the OECD Policy Brief (2000) highlighted that just less than 50% of new start-ups remain in operation for longer than five years. The lower survival rate of South African SMMEs could be harming the unemployment rate. Van Praag (2003) agreed and argued that the government has to minimise business failures and stimulate new businesses to lower unemployment.

According to Schumpeter (as cited in Wong, Ho, & Autio, 2005), entrepreneurs help generate economic growth through their innovations. In fact, Wong, Ho, and Autio (2005) explained that “entrepreneurship contributes to economic performance by introducing innovations, creating change, creating competition and enhancing rivalry” (p. 337). An increase in entrepreneurship, should, therefore, increase the number of SMMEs (assuming SMMEs are started by entrepreneurs) and increase economic growth. Olawale and Garwe (2010) confirmed that newly formed SMMEs compete with established firms, introduce new products, develop new technologies, and are an important source of innovation. An increase in SMMEs and their survival should increase economic growth and innovation. It is, therefore, important to understand how to strengthen entrepreneurship and increase the number of SMMEs in the country.

To promote economic development and strengthen the role of SMMEs (and large businesses), governments design and implement various institutions and programmes – programmes such as funding via development finance institutions, preferential tax treatments, preferential procurement contracts, business incubators for entrepreneurial support and various other initiatives.

Business incubators are organisations that facilitate small enterprise creation by providing them with a comprehensive and integrated range of services (Adegbite as cited by Peña, 2004). Incubators are used to help create and nurture firms to become more successful, grow revenue, create employment opportunities, improve innovation and increase GDP (Department of Small Business Development, 2017; Iyortsuun, 2017; Masutha & Rogerson, 2014). According to Wonglimpiyarat (2016), the Thai government used business incubators to support economic development and to help transition the economy from lower-middle income to upper-middle income status. This study will focus on business incubators as an economic development intervention.

1.2 Problem definition

There has been an increase in the number of business incubators operating and providing services to a multitude of SMMEs. From 2001 to 2019, public supported incubators in South Africa increased from three to 76, and in 2017, there were 167 business development service providers, which includes incubators (Department of Small Business Development, 2017b; SEDA Small Enterprise Development Agency, 2019a). This study aims to investigate if, on average, these incubators help SMMEs grow revenue, increase employees and increase the ability of firms to raise external capital. There is limited research to confirm if South African incubators help SMMEs increase revenue, hire more employees or raise more financing. Due to the lack of definitive research, funding continues to flow from government, the non-profit sector as well as the private sector to incubators. For example, in 2018 and 2019, the Small Enterprise Development Agency (SEDA) received in excess of R700 million from the government (SEDA Small Enterprise Development Agency, 2019a). If it is found that incubators are unable to help SMMEs grow, then there might be another, better use for these funds. An alternative use of the funds could be to finance SMMEs directly rather than offer incubator training or by providing preferential tax treatments or improving founder education.

There has been a growing use of business incubators by policy makers and local economic development practitioners (Masutha & Rogerson, 2014). This indicates a belief that business incubators help SMME and economic development. However, Masutha and Rogerson (2014) argued that there is a lack of scholarly attention on the topic of business incubation as an economic policy tool. Thus, this study aims to address the lack of academic research on the effectiveness of business incubation on SMME growth.

This research is relevant to development finance as the NDP aims to reduce income inequality and reduce poverty in the economy by 2030. This is in addition to the goal that most new jobs will be created by SMMEs. Therefore, there has been an increased focus from the government on SMMEs and there has been an increase in the number of business incubators offering support services. Based on the above, this study seeks to answer the following questions:

1. Does participation in incubator programmes improve revenue generation of SMMEs?
2. Does participation in incubator programmes improve the number of employees of SMMEs?
3. Does participation in incubator programmes improve the amount of external financing raised by SMMEs?

1.3 Research objectives

The objective of the research is to evaluate whether business incubators improve the participants financial and non-financial outcomes in South Africa. The specific objectives of the study is to:

1. Examine the effect of participation in incubator programmes on SMMEs revenue
2. Examine the effect of participation in incubator programmes on the number of employees of SMMEs
3. Examine the effect of participation in incubator programmes on external financing raised (equity, debt and philanthropic)

1.4 Justification of study

This research is important to improve the understanding of the accelerator landscape in South Africa. Specifically if incubators are able to assist SMMEs to increase revenue growth, employment opportunities and the ability to raise external funding. The creation of the Department of Small Business Development, signalled that the government believes that SMMEs play an important role in the economy. The National Planning Commission (2012) also indicated the desire to create 11 million jobs by 2030 with expectations that 90% of these are to be created by SMMEs (Masutha & Rogerson, 2014).

There has been significant capital and attention given to the introduction and creation of accelerators in the country over the last few years, from both private and public sources. Lose and Tengeh (2016) confirmed that significant resources have been invested. However, they

argued that the impact of incubators is not well documented. This study will add to the available information on incubator performance. If this study shows that there is limited proof that incubators help SMMEs, then the capital provided to them could be used more effectively elsewhere.

In a literature review of technology incubators, Mian et al., as cited by Lukeš, Longo, and Zouhar (2019), found that 54% of studies were of a qualitative nature. Of those, only 15% assessed the performance of business incubators. Additionally, Dvouletý, Longo, Blažková, Lukeš, and Andera (2018), found that peer-reviewed empirical studies on the performance of incubated firms is relatively scarce. This study, therefore, also adds to the underrepresented quantitative studies on the impact of incubators on attendee performance. It also extends the scope to incubators in emerging markets and Africa.

1.5 Constraints of the study

The main constraint of the study is that the data is self-reported and that it only covers SMMEs that voluntarily apply to accelerators across South Africa that have a relationship with the data provider. The data, as a result, does not consist of the entire universe of SMMEs as it omits accelerators that do not have a relationship with the data provider and SMMEs that are unaware of the accelerator programmes in South Africa. The results may be biased and care should be taken when extrapolating the findings to the entire universe. Another constraint is that no two incubators are the same (Schwartz, 2013). As such, the services offered by different incubators are not always equivalent, which impacts the study (Schwartz, 2013). This study does not aim to differentiate which type of incubator produces better results. Studies on sector specific or sector agnostic incubators have been conducted already, and those studies would provide more clarity on the differentiating effects of different incubators.

1.6 Organisation of study

The dissertation will include five chapters:

1. An introduction to the study, which will provide the background to the study, the problem statement as well as key questions and research objectives;
2. A literature review discussing the previous applicable theoretical topics as well as other relevant empirical studies and findings relating to incubators, SMMEs and economic growth in South Africa;

3. The methodology of the study will define the type of research undertaken, the type of data used, the analytical framework and the tools used to test the relationship between incubator enrolment and SMME performance;
4. The findings of the analysis will present the results of the analysis; and
5. A conclusion and recommendation for the study will discuss the conclusions that can be drawn from the study findings.

Chapter 2: Literature Review

2.1 Introduction

This section starts with concepts, terms and their definitions. It then provides an overview of the business incubation and SMME sector in South Africa. It will provide the theoretical framework as well as review empirical literature relating to business incubation and SMME development. The chapter will conclude with a summary of the literature reviewed.

2.2 Definitions of concepts and terms

2.2.1 SMMEs definitions, concepts and terms

The acronym SMME means small, micro, medium enterprises, which is an umbrella term for a wide range of different enterprises varying in size of revenue, employees, assets, operating premises and level of formality. This definition is echoed by Berry et al. (2002), who indicated that SMMEs consists of a variety of firms such as medium-sized family businesses, self-employed informal vegetable sellers or even more formal services enterprises such as hairdressers and dentists. According to Berry et al., (2002), the majority of SMMEs in South Africa are survivalist enterprises, but some of the larger and more formal SMMEs rival businesses in developed economies.

It is, however, important to have a formal definition for an SMME. This is to distinguish SMMEs from large enterprises and other organisations. A definition provides parameters to identify small enterprises to implement and design sector specific business support services (Department of Small Business Development, 2019a). A formal definition creates consistency, allowing statistical analysis and it aligns terminologies to apply policy consistently across different government departments (Department of Small Business Development, 2019a).

In addition, as the NDP wants 90% of new jobs to be created by SMMEs, it is important to know the government's definition for an SMME. This study will, therefore, use the definition of an SMMEs provided by the Department of Small Business Development as defined in Department of Small Business Development (2019b):

Small enterprise mean a separate and distinct business entity, together with its branches or subsidiaries, if any, including cooperative enterprises, managed by one owner or more predominantly carried on in any sector or subsector of the economy mentioned in

column 1 of the Schedule and classified as a micro, a small or a medium enterprise by satisfying the criteria mentioned in columns 3 and 4 of the Schedule. (Department of Small Business Development, 2019b, p. 1)

The schedule referred to in the definition is displayed in Table 2.1 below.

Table 2.1: Schedule of micro, small and medium enterprise definitions

Column 1	Column 3			Column 4		
	Micro	Small	Medium	Micro	Small	Medium
	Total FTE* paid employees	Total FTE* paid employe es	Total FTE* paid employe es	Total annual turnover (R)	Total annual turnover (R)	Total annual turnover (R)
Agriculture	0-10	11-50	51-250	≤ 7m	≤ 17m	≤ 35m
Mining and Quarrying	0-10	11-50	51-250	≤ 15m	≤ 50m	≤ 210m
Manufacturing	0-10	11-50	51-250	≤ 10m	≤ 50m	≤ 170m
Electricity, Gas and Water	0-10	11-50	51-250	≤ 10m	≤ 60m	≤ 180m
Construction	0-10	11-50	51-250	≤ 10m	≤ 75m	≤ 170m
Retail, Motor trade and Repair Services	0-10	11-50	51-250	≤ 7.5m	≤ 25m	≤ 80m
Wholesale	0-10	11-50	51-250	≤ 20m	≤ 80m	≤ 220m
Catering, Accommodation and Other Trade	0-10	11-50	51-250	≤ 5m	≤ 15m	≤ 40m
Transport, Storage and Communications	0-10	11-50	51-250	≤ 7.5m	≤ 45m	≤ 140m
Finance and Business Services	0-10	11-50	51-250	≤ 7.5m	≤ 35m	≤ 85m
Community, Social and Personal Services	0-10	11-50	51-250	≤ 5m	≤ 22m	≤ 70m

Source: Department of Small Business Development, 2019b

*Full-time equivalent

The definition and the schedule indicates that a micro enterprise should not have more than 10 employees, or more than R5m to R20m in annual revenue (depending on the sector). A small enterprise should not have more than 50 employees and more than R15m to R80m in annual revenue. A medium sized enterprise should not have more than 250 employees and more than R35m to R220m in annual revenue.

2.2.2 Business incubators definitions, concepts and terms

An organisation is considered a business incubator if it facilitates early-stage business development by offering office space, shared support services, business assistance or advice,

and a controlled environment to network and accelerate business growth (Hackett & Dilts, 2004a; SEDA Small Enterprise Development Agency, 2018; Tavoletti, 2013; Theodorakopoulos, Kakabadse, & McGowan, 2014).

The data used in the study is from the Global Accelerator Learning Initiative (GALI). GALI discloses that the data is collected from surveyed entrepreneurs that had applied to accelerators and entrepreneur support programmes (GALI, n.d.). Business accelerators provide: “time-limited programmes that work with cohorts or ‘classes’ of ventures to provide mentorship and training, with a special emphasis on connecting early stage ventures with investment” (Aspen Network of Development Entrepreneurs, 2018, p. 5).

In South Africa, there appears to be a conflation of the definitions of accelerators and incubators. Through a series of workshops with practitioners, Aspen Network of Development Entrepreneurs (2018) found a lack of clarity on the definitions of accelerators and incubators. According to the Aspen Network of Development Entrepreneurs (2018), practitioners that self-identify as accelerators might market themselves as incubators rather than accelerators. The same may be true for self-identified incubators. Regardless of how they self-identify, the services that were offered almost unanimously were mentorship, access to networks and business strategy or training (Aspen Network of Development Entrepreneurs, 2018). The programmes are generally offered to firms on a cohort basis (Aspen Network of Development Entrepreneurs, 2018).

South Africa’s Small Enterprise Development Agency (SEDA) acknowledges various different incubator and accelerator models as shown in the Table 2.2 below (SEDA Small Enterprise Development Agency, 2018).

Table 2.2: Comparison of Business Development Support Provider models

Facilities and services	Business Incubators	Technology Demonstration Incubators	Hybrid Incubators	Accelerators
Physical space	X	X	X	X
Product/ process identification	N/A	X	X	X
Access to equipment, machines, tools and IT infrastructure	N/A	X	X	N/A
Shared administrative services	X	X	X	X
Technical training, counselling, mentoring and coaching	X	X	X	X
Technology Transfer and demonstration	N/A	X	X	X
Assistance in marketing	X	X	X	X
Technology commercialisation	X	X	X	X
Assistance with sourcing finance	X	X	X	X
Assistance in export readiness	X	X	X	N/A

Source: SEDA Small Enterprise Development Agency, 2018

There are a number of overlapping services offered by incubators and accelerators. According to SEDA Small Enterprise Development Agency (2018) these common services are physical space, shared administrations services, technical training and mentoring, marketing, technology commercialisation, and assistance to source finance. Mentoring, business strategy and training were services unanimously offered by respondents in the Aspen Network of Development Entrepreneurs (2018) study.

Therefore, for the purpose of this study, business incubators and business accelerators will be used interchangeably due to the similarities of services offered as well as the conflation of definitions by practitioners.

Incubator or accelerators are organisations whose purpose is to facilitate early stage business development. They facilitate this by offering various services to businesses on a cohort basis. The services include, but are not limited to, physical space, administrative support, strategic support, strategic training, networking, and assistance to source financial capital (Aspen Network of Development Entrepreneurs, 2018; Hackett & Dilts, 2004a; SEDA Small Enterprise Development Agency, 2018; Tavoletti, 2013; Theodorakopoulos, Kakabadse, & McGowan, 2014).

2.3 Overview of SMMEs and business incubation in SA

2.3.1 Overview of SMMEs in SA

2.3.1.1 Size and background of the SMME market; formal vs. informal and sector breakdown

There are approximately 3.5 to 4.3 million formal, non-agricultural SMMEs found in Sub-Saharan Africa (Kumar, 2017). Estimates of the number of SMMEs in South Africa ranged from between 250,000 and 1 million at the low-end and up to 6 million at the high-end (Bureau for Economic Research, 2016; Makwara, 2019; The World Bank, 2018d). In the first quarter of 2019, the number of SMMEs in South Africa was estimated to be close to 2.6 million (SEDA Small Enterprise Development Agency, 2019b), which seems realistic in comparison to the Kumar (2017) study.

Formal SMMEs are businesses that are formally registered organisations, whereas informal businesses are predominantly self-employed persons running micro-enterprises from poorer segments of the population. These enterprises generally generate low income and limited employment (Bureau for Economic Research, 2016; TIPS, 2017b). The SEDA Small Enterprise Development Agency (2019) research estimated that approximately 69% of the close to 2.6 million SMMEs are informal (see Table 2.3 below).

Table 2.3: Key indicators of SMMEs

KEY INDICATORS	1Q2018	4Q2018	1Q2019
Number of SMMEs	2 443 163	2 557 762	2 550 540
Number of formal SMMEs	658 719	745 061	736 198
Number of informal SMMEs	1 714 233	1 744 013	1 754 443
Number jobs provided	8 886 015	10 597 371	10 839 819

Source: SEDA Small Enterprise Development Agency, 2019b

2.3.1.2 SMME contribution to the South African economy:

2.3.1.2.1 SMME contribution to GDP

Estimates for SMMEs' contribution to South Africa's economy measured by GDP varies from 40% at the low end to between 51% and 57% on the high end (Bhorat, Asmal, Lilenstein, & van der Zee, 2018; Economic Policy Division National Treasury, 2019; Kongolo, 2010; Ngek & van Aardt Smit, 2013; The World Bank, 2018a). In comparison to other countries, the South African SMME sector underperforms economic contribution. In low-income countries, formal

and informal SMMEs contribute 60% of GDP and in middle-income countries SMMEs contribute 70% of GDP (Ayyagari et al. as cited by The World Bank, 2018a).

2.3.1.2.2 SMME contribution to employment

According to SEDA Small Enterprise Development Agency (2019b), SMMEs provided employment to 10.84 million people in the country (see Table 2.3). The SMME sector, therefore, accounted for approximately 66% of the 16.4 million employed people in the country (Statistics South Africa, 2020). This contribution is disappointing compared to low-income and middle-income countries. In low-income and middle-income countries, SMMEs contribute more than 70% and 95% of employment opportunities, respectively (Ayyagari et al. as cited by The World Bank, 2018a).

2.3.1.3 SMME survival rate

There is relatively widespread agreement that the South African SMME failure rate is high. Estimates of the failure rate within the first year ranges from 40% to 80% (Bushe, 2019; Department of Small Business Development, 2017; Economic Policy Division National Treasury, 2019). Over 3 years, the failure rate is estimated to be 80% (TIPS, 2017a) and after 10 years the failure rate climbs even higher to 90% (Bushe, 2019; Economic Policy Division National Treasury, 2019). In comparison, the OECD Policy Brief (2000) highlighted that less than 50% of new start-ups remain in operation for longer than five years in developed economies.

2.3.1.4 SMME by demographic

According to TIPS (2017b), SMMEs are predominantly concentrated in the retail sector and to a lesser extent in construction and business services. There are a limited number of SMMEs in the manufacturing sector and even fewer in the mining sector, which is likely due to the large capital investment required in those industries. With regards to the ownership breakdown of formal SMMEs by race and gender, TIPS (2017b) indicates that the demographics have become more representative, but lags far behind the national population breakdown.

2.3.1.5 SMME struggles

There are a number of areas with which SMMEs struggle that hinder their profitability and ability to grow. These are discussed below.

An area of weakness for SMME founders is a lack of business skills. This is related to a lack of peer learning, networking and limited business training programmes available. Poor business skills may also be due to poor education outcomes due to low quality primary and secondary education and expensive tertiary education. Highly skilled workers are also more likely to work at larger companies which may have improved job security and growth prospects. As a result of limited access to scientific knowledge, SMMEs also struggle with research and development initiatives which constrains their level of innovation (Akçomak & Taymaz, 2004; Bureau for Economic Research, 2016; Department of Small Business Development, 2017; The World Bank, 2018b; The World Bank, 2018d).

Access to, and the cost of finance, is something with which many SMMEs struggle. The lack of available financing is due to low risk tolerance of capital providers, stringent lending criteria, collateral requirements and asymmetric information. Finance providers lack information to appropriately measure the risk level of a borrower (Akçomak & Taymaz, 2004; Bureau for Economic Research, 2016; Bushe, 2019; Department of Small Business Development, 2017; Economic Policy Division National Treasury, 2019; Masutha & Rogerson, 2014; The World Bank, 2018d).

SMMEs struggle to access markets (both upstream and downstream) which includes large commercial or government value chains. This lowers their ability to generate revenue and obtain economies of scale (Akçomak & Taymaz, 2004; Bureau for Economic Research, 2016; Bushe, 2019; Economic Policy Division National Treasury, 2019; The World Bank, 2018d).

SMMEs struggle to access appropriate equipment and infrastructure such as physical premises or electricity (Akçomak & Taymaz, 2004; Bureau for Economic Research, 2016; Masutha & Rogerson, 2014; The World Bank, 2018d). Labour laws make it difficult for SMMEs to downsize workforces when required. Minimum wages are high, making labour costs a larger percentage of expenses for SMMEs compared to larger businesses (Bureau for Economic Research, 2016; Economic Policy Division National Treasury, 2019). There are many regulatory and legal barriers which increase compliance and tax costs. In addition, uncoordinated policy between different government organisations and departments increases the costs of compliance (Bureau for Economic Research, 2016; Economic Policy Division National Treasury, 2019; The World Bank, 2018d).

A lack of networking between SMMEs reduces the opportunity to share business knowledge, opportunities and skills. This struggle also extends to a lack of high quality mentors in the ecosystem (Department of Small Business Development, 2017; Masutha & Rogerson, 2014).

2.3.2 Overview of the incubator industry in SA

Broadly speaking, business incubators are organisations that form part of a wider group of organisations that are called business development service providers (BDSPs). BDSPs provide strategic or operational development services to entrepreneurs. Business development services (BDS) are services and products designed to meet the business needs of individual entrepreneurs at various stages of their enterprises' growth and development to improve their enterprises' performance, access to markets and ability to compete (Committee of Donor Agencies for Small Enterprise Development, 2001; Department: Trade and Industry Republic of South Africa, 2014).

A study commissioned by the Department of Small Business Development (2017) mapped out the ecosystem for small enterprises in South Africa. The study highlighted eight types of services (pillars) that influence and support entrepreneurs and enterprises. According to Department of Small Business Development (2017), these pillars are:

1. Finance
2. Skills and Talent
3. Technology and Infrastructure
4. Markets and Inputs
5. Business Support Services
6. Policy and Regulation
7. Administration
8. Mind-set

The Department of Small Business Development (2017) study goes on to identify four groups of organisations (actors) within the ecosystem which provide the services. A total of 502 actors are from government and the private sector:

1. Finance providers (187 counted): these actors make finance available to firms through various financial instruments that are firm size and life stage appropriate (Department of Small Business Development, 2017)

2. Ecosystem builders (111 counted): support the business development ecosystem by increasing access to markets, improving knowledge transfer, and advocating for changes in regulation (Department of Small Business Development, 2017)
3. Education providers (37 counted): educate and equip individuals with skills to start enterprises or can be value adding employees (Department of Small Business Development, 2017)
4. Business development services providers (167 counted): organisations that provide non-financial services to firms with varying needs and at various life stages (Department of Small Business Development, 2017)

Table 2.4 below indicates how each ecosystem actor supports each pillar of service to support firms.

Table 2.4: Each actor provides a different or multiple services/ pillars:

	Pillar/ service	Type of service provider
1	Access to finance	Finance providers
2	Skills and talent	Education providers
3	Technology and infrastructure	Business development service providers
4	Markets and inputs	Ecosystem builders & Business development service providers
5	Business support services	Ecosystem builders & Business development service providers
6	Policy and regulation	Ecosystem builders
7	Administration	Ecosystem builders & Business development service providers
8	Mind-set	Ecosystem builders

Source: Department of Small Business Development, 2017

Types of BDS providers

BDSPs can be non-profit, for-profit, government agencies or corporate organisations (Department of Small Business Development, 2017). This study is focussed on incubators or accelerators as discussed in the definitions subsection. Incubators and accelerators are a subset of BDSPs and as discussed previously are often conflated. Besides incubators and accelerators, other BDSPs include research organisations, consultants and enterprise supply chain developers (Department of Small Business Development, 2017).

Number of Incubators

In 2001, there were only three public sector business incubators in South Africa. By 2019, SEDA (or government) supported incubators accounted for 76 of all incubators in the country (SEDA Small Enterprise Development Agency, 2019a).

Incubator characteristics

The most commonly used characteristics to identify a South African incubator are geographical focus, if it is publicly or privately funded, and its sector of focus (Department: Trade and Industry Republic of South Africa, 2014).

Department: Trade and Industry Republic of South Africa (2014) counted 105 incubators in South Africa, of which, approximately 75% were located in Gauteng, the Eastern Cape, KwaZulu-Natal and the Western Cape. Approximately 24% of these incubators were privately run, the remaining 76% were found to at least be partly funded by Government through the incubation support programme (ISP) or the SEDA technology programme (STP) (Department: Trade and Industry Republic of South Africa, 2014). Masutha and Rogerson (2014) highlighted that private incubators are mainly concentrated in major urban centres. This is contrasted by public sector incubators that are more geographically spread outside of metropolitan areas. This is likely a deliberate attempt to place public sector incubators closer to the public and part of government's attempt at spatial redress (Masutha & Rogerson, 2014).

Incubator Services

As incubators differ by geographic focus, funding model and sector preference, so too do the services they offer. Services may differ depending on their operating sector focus, their operating region and per different incubator operators (ILO; UNECE as cited by Ndabeni, 2008).

One thing is consistent though, that there is targeted business support. Targeted business support is a significant factor for improving developing country SMME performance in terms of economic growth, poverty reduction and increased employment (Ageze as cited in Barnes, 2018). The various services that BDSPs and incubators provide to SMMEs are as follows:

Masutha and Diedericks (as cited by Lose, Magoda, Maziriri, & Madinga, 2016) explain that incubators provide small businesses with technical and business consulting as well as infrastructure support services. Masutha and Rogerson (2014), cited Ndabeni, which also confirmed that technical and business services are provided in addition to infrastructure or office space. They go on to name networking and financial assistance as other services that incubators provide.

In their study of Europe and the Middle East, Al-mubarak and Busler (2012) found that incubators offer financial support, advisory services, mentoring or coaching services, incubation facilities, incubation services (internet and photocopy services for example), networking and marketing, and technology transfer and commercialisation. Fal (2013) found that in Africa, services from accelerators and incubators assist entrepreneurs to formalise and grow their businesses. The services offered by African accelerators included setting up physical offices and providing networks for advisory services and funding (Fal, 2013).

2.4 Theoretical framework: Business incubation and SMMEs development

The next subsection will discuss the theoretical framework of the study. Hackett and Dilts (2004b), by quoting Sutton and Staw, indicated that a good theory explains why empirical patterns were, or are expected to be observed. A theory describes the causal relationship between observable variables and unobserved constructs that can be generalised to a distinct phenomenon (Bacharach as cited by Hackett & Dilts, 2004b).

Business development service providers and incubators provide services to SMMEs with the goal of assisting their growth and success. In fact, according to Masutha and Rogerson (2015), the main objective of public business incubators is to increase economic participation, transfer skills and create jobs for the SMME sector. Private sector incubators aim to increase turnover and profit margins for the firms. The theoretical framework, therefore, provides the theory of why a business incubator would improve a SMMEs “economic participation” and ability to “create jobs and increase its turnover” (Masutha & Rogerson, 2015). The theoretical framework also highlights the theories, concepts and definitions that are relevant to the topic of business incubation and SMME growth (Grant & Osanloo, 2014). According to Charry, Pérez and Barahona (2014), there are numerous theoretical frameworks to understand and study business incubators.

An example of theoretical frameworks would be a study performed by Fatoki (2011) which investigated the impact of human, social and financial capital on SMMEs in the Eastern Cape Province of South Africa. Fatoki (2011) cited Ahmad et al. and Marshal and Oliver to argue that the success or failure of SMMEs is dependent on the level of human capital (measured by skill, knowledge, experience, education and ability of the SMME's owner) and that a lack of finance (financial capital) or supportive social network (social capital and network theory) may increase likelihood of failure. The theoretical frameworks that are important for this study are, therefore, human capital, social capital and network theory, financial capital and resource based theory.

2.4.1 Human capital

The theory of human capital, argues that human performance improves with increased education and training (Becker; Schultz as cited by Fatoki, 2011). In fact, Peña (2004) found that human capital affects the survival rate, employment growth and sales growth of incubated firms. Entrepreneurs who obtained a higher level of education, had more managerial experience, and capitalised on ideas from previous jobs, were more likely to create a successful company (Peña, 2004). Management training and assistance services provided by incubators are, therefore, positively associated with firm growth, entrepreneurship development and the ability of entrepreneurs to take advantage of business opportunities (Li, Ahmed, Qalati, Khan & Naz, 2020; Peña, 2004)

2.4.2 Social capital and network theory

Fatoki (2011) discussed the resource dependency theory of social capital which was developed by Pfeffer and Salancik. The theory argues that a firm's success is dependent on its resources and supporting networks. According to Tötterman and Sten (2005), Nahapiet and Goshal declared that networks provide access to resources. Therefore, a lack of network connections result in firms relying on third party interaction to acquire necessary resources. In addition, personal relationships create opportunities and existing network relations will support the creation of new relationships in future. Petrucci (2018) argued that besides personal relationships and social capital, firms are also highly dependent on surrounding enterprises to gain legitimacy and develop resources via their business relationships. Businesses do not operate in a vacuum; activities and operations happen in dense, dynamic networks of business relationships such as with clients and suppliers (Håkansson & Waluszewski as cited by Petrucci, 2018). Therefore, when investigating business incubators, incubated firms cannot be

analysed in isolation from the incubator itself and its external networks (Snehota cited in Petrucci, 2018). This theory postulates that firms incubated with a stronger network and an incubator manager with influential relationships, would outperform those with managers with weaker connections and relationships (Fatoki, 2011; Petrucci, 2018; Tötterman & Sten, 2005). In fact Li et al. (2020) quoted Khan et al. who found that networking services help entrepreneurs to attract more customers, obtain knowledge, achieve growth and increase profits.

2.4.3 Financial capital

The capital structure theory postulates how a firm is financed (either through debt or equity). The capital structure should maximise the tax benefit from debt financing while minimising the distress cost from excess debt (Scott, Kraus & Litztenberger as cited by Fatoki, 2011). The pecking order theory argues that firm management uses internal financing before external financing, and when external financing is required, the least risky financing is preferred. This indicates that firms will use internal financing before externally raising debt and then equity financing (Fatoki, 2011). Li et al. (2020) found that capital support to start-up firms, which is essentially venture capital or start-up financing, positively supports business and entrepreneurship development. The use of venture capital (equity) financing would be preferred over debt financing as the distress cost from debt financing would be high for start-ups with uncertain cash flows. Colombo and Delmastro (2002) showed that incubated firms were able to access public funding easier when compared to non-incubator firms. In their study, 51% of incubator firms received public subsidies compared with 33% of the non-incubator sample. This confirms that an incubated firm receives more financial support (Colombo & Delmastro, 2002).

2.4.4 Resource based theory

According to Tembe (2018), resource based theory explains why and how businesses utilise and deploy resources. Penrose, cited in Tembe (2018), argued that a firm's resources are made up of various capabilities and assets that can be used to capitalise on opportunities. Firms can create economic value if they are able to effectively and innovatively manage their resources to exploit market opportunities (Tembe, 2018). This happens when experienced managers have insight into the productive opportunities available for their firms. These managers are able to convert firms' resources into new services and products, which leads to economic value creation. The lack of managerial and technical skills is a bottleneck to a firm's growth (Tembe,

2018). Under this discussion of resource based theory, it is clear that management skill and knowledge is important to catalyse enterprise resources to initiate enterprise growth. Additionally, Eveleens et al. (as cited by Dvouletý et al., 2018) argued that access to finance, office space, business networks and mentoring are resources that create a competitive advantage in incubated firms. Therefore, incubated firms which have access to these resources will outperform comparable non-incubated firms (Dvouletý et al., 2018).

2.5 Empirical Literature

The following sub-section provides a review on various studies that investigated the relationship between business incubators and the development of incubated businesses.

Incubated firms find the following useful in the development of their firms:

There is evidence that indicates that incubated firms are satisfied with the services received from incubators. If entrepreneur satisfaction is a valid predictor of success, then these studies would indicate that there is success. Lose and Tengeh (2016) conducted a survey of incubated SMMEs in the Cape Metropole Area in the Western Cape, South Africa and found that 78% of respondents had achieved their objectives by attending the business incubator, and believed that their attendance would lower their failure rate. Interestingly 18% of respondents indicated their main objective for attending the incubator was to improve their growth, while the majority, 61%, indicated they had more than one objective either, growth, skills, finance, networking or other. This finding corroborates an earlier study in the USA by Mian (1996) who found that university technology business incubators (UTBIs) provide a nurturing environment for the development of new technology based firms (NTBFs). Most respondents to the survey believed that the services received through the UTBI was adding value to their firm, the services and university-related inputs that were highlighted included university image, laboratories, equipment, and student employees. Mian (1996) concluded that UTBIs, therefore, contribute to the growth and survival of their tenants by nurturing NTBFs. Similarly, Tötterman and Sten (2005) found that tenants of incubators benefit from participating in the incubator community by sharing experiences and knowledge, essentially benefitting from the positive network effect. Of the services that incubators provided, the tenants in the Tötterman and Sten (2005) study indicated that they were most satisfied with support to create and improve their business networks and least satisfied with support to provide office space and facilities.

There is insufficient evidence to indicate that business incubators are associated with SMME development:

Dvouletý et al. (2018) argued that the use of employment growth as a start-up performance measure is unwise as start-ups must be well controlled (in terms of spending on new employees) in order to achieve long-term viability. Employment growth is generally considered the goal of public policies while for-profit firms and entrepreneurs aim to grow sales and profitability to sustain operations (Dvouletý et al., 2018). Sales and profitability can be volatile or non-existent in the short-term, which is when nonfinancial measures are more useful. Another shortcoming of using revenues as a sole measure of incubated firm performance is that incubators often attract firms that do not generate revenues during their start-up phase as they are in the technology sector (Dvouletý et al., 2018).

There is research that finds evidence that incubators have firms that perform worse than non-incubated firms. A study on American university-based start-ups by Ensley and Hmieleski (2005), found that university based start-ups perform worse than independent new firms. Start-ups underperform in terms of net cash flow and revenue growth. The findings also indicated that university-based start-ups had more homogenous top management teams with less developed dynamics than their independent counterparts. Similarly, in a recent study of Czech publicly funded incubators, Dvouletý et al. (2018) found that incubated firms had lower sales, lower asset turnover, lower margins, lower asset values, but had lower wage expenses. The study was conducted over a relatively short time-frame between 2013 and 2015 which could explain the results. As Lukeš et al. (2019) found that, in the short term, Italian start-ups that participated in incubators had negative sales growth. However, sales growth appears to improve over a longer period (after 3 or 4 years).

If survival rates are considered to be an estimator for SMME performance, then a 10 year study conducted by Schwartz (2013) showed that 371 incubated German firms are unlikely to remain in business for longer than similarly matched non-incubated German firms.

A study by Peña (2004) on 114 firms from 9 incubators in Spain, revealed that services provided by business incubators did not add significant explanation to the reason for business growth (measured by sales and employment). The Peña (2004) model, however, found that the effect of human capital was a more significant contributor to explaining why businesses grow.

Peña (2004) concluded that, “the most influential determinants for new business survival and growth are those factors representing the human capital of the entrepreneur” (p12).

Positive effect of incubation on revenue growth, employment and survival rates:

In comparison to the studies that found that incubated firms had lower revenue growth and negative net cash flow compared to non-incubated firms, Autio and Rannikko (2016) found that incubated firms had strong positive sales growth. The Autio and Rannikko (2016) study took place in Finland, comparing 160 firms in the NIY Programme (a high growth policy initiative) to 66 (matched) firms that did not take part in the programme. After 1 year in the programme, treated firms had sales growth that was 120% greater than untreated firms. The results were both statistically significant (2-tailed significance) and persisted over three years. A potential differentiating factor of the NIY Programme might, however, be that the programme offers financial support to treated firms to obtain services for business planning, growth strategy development and to improve the firm’s management skills. The programme offers up to €1M in funding, granted over several instalments to the firms’ organisational capabilities (Autio & Rannikko, 2016). Additionally, the programme operates on milestones or goals; when firms are selected, they are allocated customised milestones. To remain in the programme and progress to the next phase of support and funding, firms are required to meet their milestones. This means that, as firms meet milestones and remain in the programme for longer periods, they obtain both more funding and support of higher quality, which could further increase their growth potential.

Importantly for this study, Colombo and Delmastro (2002) found that incubated firms show higher post-incubation employment growth rates when compared to non-incubator firms (after adjusting for other external factors such as human or financial capital, start-up size or other explanatory variables). Colombo and Delmastro (2002) also showed that Italian incubators managed to attract entrepreneurs with better human capital. Additionally, incubated firms are better at adopting new technologies, are more likely to participate in international R&D programmes, and find it easier to collaborate with universities and access public subsidies. A limitation to their study, however, was the low number of observations (45 matched incubated and non-incubated firms) (Colombo & Delmastro, 2002).

Similarly in Sweden, Löfsten and Lindelöf (2002), found that when comparing 134 incubated new technology based firms (NTBFs) to 139 non-incubated NTBFs, incubated firms had

comparatively higher rates of employment growth. Their analysis, which was completed over a three-year period, also significantly found that incubated NTBFs have higher sales growth (Löfsten & Lindelöf, 2002). Additionally, incubated NTBFs were found to have more formal links with universities, but were unable to translate that to higher patents or higher profits (Löfsten & Lindelöf, 2002).

A study comparing incubator firms with non-incubator firms in the USA by Stokan, Thompson and Mahu (2015) confirmed that incubators have a positive effect on the employment creation abilities of participants. Stokan et al. (2015) observed that, after controlling for non-incubator effects on growth, incubator firms generate 58% more jobs than non-incubator firms. Another finding was that incubator firms receive five times more business services (legal, financial, marketing, etc.) than non-incubator firms (as per the samples: on average 3.79 business services compared to an average of 0.75 business services) (Stokan et al., 2015). The authors postulated that the higher number of business services could be a function of a network effect, in that incubators provide networks and access to outside business services, which reduces costs and time to find these services, and helping incubated firms to grow faster (Stokan et al., 2015).

Most incubators offer financial support or access to external financing (Al-mubarak & Busler, 2012; Barnes, 2018; Masutha & Rogerson, 2014). If incubators only provide financial support in the form of a financial grant, then this “service” would likely result in greater sales and employment growth compared to firms that are not incubated. For example, Lerner (2000) found that firms that receive financial grants from the USA based, small business innovation research (SBIR) programme enjoy significant employment and sales growth, when compared to similarly matched non-incubated firms. The superior sales and employment growth is, however, predominantly for firms based in areas with significant venture capital activity and are more pronounced in high-technology industries (Lerner, 2000). Government agencies award the SBIR programme grants to deserving and qualified firms based on certain qualifications and quality of proposal. The grant is awarded without having to relinquish part ownership or intellectual property rights (Lerner, 2000). Lerner (2000) also found that the award acts as a signal, and awardees are more likely to receive venture capital funding.

In a recent survey study in the United States to identify if incubator quality or the economic capacity of the surrounding region affect the success of tenant and graduate incubated firms, Harper-Anderson and Lewis (2018) confirmed that business incubator quality is a more reliable

predictor of firm success. The authors used employment and revenue growth as well as the number of graduates for incubator tenants and the survival rate for incubator graduates as measures of success (Harper-Anderson & Lewis, 2018). The incubator quality factors include incubator resources, services, and management practices, while economic regional capacity factors include locally available capital, labour, innovation, knowledge, and wealth (Harper-Anderson & Lewis, 2018). The findings mean that incubators are important in impacting revenue growth, employment growth and survival or incubator graduation rates.

Studies of incubator efficacy in emerging markets are rare compared to studies in developed economies. However, Akçomak and Taymaz (2004) assessed the effectiveness of technology incubators on SMMEs in Turkey. Their findings were similar to studies conducted in the USA and Sweden as discussed previously, but contrast with the findings of Dvouletý et al. (2018) on Czech incubators. Akçomak and Taymaz (2004) found that, compared to non-incubator firms, incubated firms have superior employment and sales growth. However, they found no significant difference in the level of innovative output for incubated firms. In discussing the reasons for the difference in performance, financial support mechanisms and various support services were found to be important (Akçomak & Taymaz, 2004). For example, 67% of the firms that received financial support indicated that it was critical for development (Akçomak & Taymaz, 2004). Akçomak and Taymaz (2004) argued that entrepreneur characteristics, business networking, and university interactions are not strong enough factors to explain the difference in performance between incubated and non-incubated firms. This argument disagrees with assertions by Stokan et al. (2015) regarding networking, and Peña (2004) regarding human capital or entrepreneur characteristics.

Van Praag and Versloot (2007) investigated the effect of entrepreneurship on the economy and concluded it has important economic value. According to Van Praag and Versloot (2007), entrepreneurs help increase productivity, create jobs and profit from product innovations. Li et al. (2020) found that business incubators play a significant supporting role for entrepreneurship development. These studies, taken together, imply that incubators aid entrepreneurial development which effectively induces employment growth, productivity growth and innovation. The business incubator services that Li et al. (2020) specifically examined and were found to positively impact entrepreneurial development were network services, capital support services and training programmes.

Tembe (2018) analysed whether the type of incubator – either sector specific or mixed sector incubators – was a better predictor of SMME performance (measured by turnover and employment growth) in South Africa. The results suggest that the type of business incubator that a firm joins (whether sector specific or mixed sector) is not a significant predictor of increase in turnover and job creation after being incubated. “There is no statistically significant difference between sector specific and mixed sector business incubators in improving SMMEs’ performance measured by job creation and turnover” (Tembe, 2018, p. 90). The findings, however, suggested that turnover and job creation are positively correlated with being incubated (Tembe, 2018). The Tembe (2018) findings, therefore, indicate inconclusive evidence that South African business incubators (regardless of type) predict improved employment and turnover growth.

In an analysis of the effectiveness of publicly funded business advisory hubs on Canadian entrepreneurially focussed SMMEs, Cumming and Fischer (2012) found that the number of advice hours received from mentors significantly and positively impacted SMME turnover and investment, even after controlling for sample selection and endogeneity. The authors found that advising hours were also positively related to patents and alliances. However, the causality was more ambiguous (Cumming & Fischer, 2012).

Rothaermel and Thursby (2005) conducted a study on incubated firms at the Advanced Technology Development Centre, a technology incubator sponsored by Georgia Institute of Technology in Atlanta, Georgia, USA. Rothaermel and Thursby (2005) investigated how knowledge flows from universities to incubator firms, and if the flow of knowledge has a positive impact of firm performance, measured by funding, revenue and graduation rates. The authors used incubated firms’ patent applications that cite university research as a proxy for knowledge flow from universities. The study found that knowledge flows has a positive impact on incubated firm performance. The presence of knowledge flows is a positive predictor for total funding and venture capital fund raising for incubated firms (Rothaermel & Thursby, 2005). The probability of outright failure is reduced in incubated firms where there is a presence of knowledge flowing from universities to incubated firms (Rothaermel & Thursby, 2005). The authors argued that revenue is a poor predictor of early stage technology firm performance, as revenues are rare in young (< 3years old) technology firms while they develop new technology. The findings of the Rothaermel and Thursby (2005) study indicated that knowledge flows are not statistically significant in predicting revenue growth.

In a study on the effectiveness of Nigerian incubators on firm survival, Iyortsuun (2017) found that the quality, comprehensiveness and length of business development services and the financial, marketing and human resource strategies and strategic business policies were important predictors of firm survival. Factors that were not important to predict firm survival were incubators' abilities to choose high performing firms and resource availability for incubated firms (Iyortsuun, 2017). Iyortsuun (2017) found that business incubators explain only 13.5% of the variance of firm survival and explained that the findings were low due to numerous factors outside the control of business incubators which influenced firms' survival rates. The findings implied that business incubators in Nigeria were only responsible for explaining less than 20% of the variance in firm survival and other external factors accounted for the majority of the variance in firm survival rates.

2.6 Summary of literature

This chapter provided the definitions of SMMEs and business incubators. The chapter also provided a general overview of the SMME industry in South Africa as well as the demographic composition of SMMEs and the struggles the industry faces. The concept of business incubation was explored and how the industry is structured in the country as well as incubator demographics, services and struggles. The theoretical frameworks exploring the theory of why business incubators should help SMMEs were discussed. This was followed by a discussion of various empirical studies that both confirmed that incubators assist incubated firms in various ways including in increased revenue, employment growth and funding, and denied that incubated firms did not perform better than non-incubated firms when comparing revenue, employment and various other performance measures. There is limited empirical research on the effect that incubators have revenue and employment growth on SMMEs in emerging markets and in South Africa specifically. This study will, therefore, fill the lack of empirical data on South African incubators. The following chapter will discuss the methodology of this study.

Chapter 3: Methodology

3.1 Introduction

This chapter will discuss the research methodology used to determine if incubator participation resulted in increased firm performance. The reason for using a quantitative research approach will be discussed. The chapter will cover why a cross-sectional research design was chosen and includes a discussion on the secondary data that was used. The data was obtained from the Entrepreneurship Database Programme at Emory University, USA, supported by the Global Accelerator Learning Initiative (GALI), referred to as GALI data henceforth. The multiple regression analysis technique and the validity of the methodology is also discussed in the chapter.

3.2 Research approach

This study performed explanatory research to explain the “why and how” of a phenomenon (Bhattacheree as cited by Alhassan, 2018). A deductive explanatory research approach was used to test how incubated firms’ performance was affected relative to non-incubated firms.

The research was performed quantitatively, using secondary numerical data (GALI data). A quantitative approach was preferred as it allowed the study to reach a conclusion based on empirical evidence. Creswell (as cited by Seroka, 2018) argued that quantitative studies explain phenomena by collecting and statistically analysing numerical data.

3.3 Research design

According to Memba (2011), the research design presents a framework for the collection and analysis of data to test a hypothesis. The following sections describe the analysis framework and data collection technique that was used in the study.

The study used a cross-sectional research design as the dependent variables were compared across one point in time. The cross-sectional design compared the results of two groups of firms at the follow-up data collection point in the GALI data. The two groups were: firms that completed an incubator programme, and firms that did not complete an incubator programme. The design was similar to that of Tembe (2018) who used cross-sectional research and compared the performance of sector specific and mixed sector incubators using SMME results

at a particular point. Importantly, the results only represented what happened up until the follow-up data collection point (Olsenas cited by Tembe, 2018). Cross sectional research was preferred over longitudinal or panel research as the data only had two time periods with a limited number of responses over both periods.

The statistical analysis technique that was used was multiple linear regression. The regression model was used to test if there was a linear relationship between the independent variables (incubator completion, firm age, etc) and each dependent variable which was the firm's performance measured by revenue, employees, equity finance, debt finance and philanthropic finance (Uyanık & Güler, 2013).

3.3.1 Data source and sample

This study used secondary, cross sectional data obtained from the Entrepreneurship Database Programme (EDP) at Emory University based in Atlanta, USA, supported by GALI. The EDP collected data from multiple global accelerators and entrepreneur support programmes (GALI, n.d.). The programme collected the detailed data when entrepreneurs applied to accelerators (application point) and follow-up data was collected one year later (follow-up point). Data was collected from entrepreneurs who applied to accelerators regardless of if they were accepted into the accelerator or not. Data was available for all applicants during the period from 2013 to 2019 and follow-up data from 2013 to 2018. As the study used secondary data, ethical clearance was not specifically required. Ethical clearance was, however, obtained on 3 July 2020, during the development of the dissertation.

The full database (after incomplete and duplicate information was removed) consisted of 23,368 international ventures whose founder entrepreneurs applied to 369 different accelerator programmes run by more than 130 different organisations (GALI, 2020). The follow-up data consisted of 19,449 ventures. Follow-up data was available for 370 South African ventures between 2013 and 2018 (GALI, 2020).

This study used the follow-up dataset and removed all other countries except for the 370 firms that had South African operations. The study then removed all the firms that did not complete the follow-up survey, which left 182 firms. Firms that did not complete the follow-up survey were omitted as the cross-sectional study used the data obtained at the follow-up collection point. The follow-up response rate was 49% (182 of 370). Of the 182 ventures that completed

the follow-up survey, 96 firms completed an accelerator programme, a completion rate of 52.7%. Table 3.1, below, confirms the incubator programme completion and follow-up survey completion numbers.

The author checked if the 182 firms were SMMEs as per the definition as in Department of Small Business Development (2019b). One firm exceeded the upper threshold for revenue at the follow-up point, however, they did not exceed the upper threshold for employees or revenue at the application point. Another company exceeded the upper threshold for employees at the application point, however they were below the upper revenue threshold, and had fewer employees at the follow-up point. Therefore, the author was satisfied that those companies were considered SMMEs as both thresholds were not exceeded at both survey points.

Table 3.1: Overview of data characteristics

	Did not complete follow-up survey	Completed follow-up survey	Grand Total
All other countries	10846	8233	19079
Did not finish the accelerator programme	9527	3629	13156
Finished an accelerator programme	1319	4604	5923
South Africa	188	182	370
Did not finish an accelerator programme	167	86	253
Finished an accelerator programme	21	96	117
Grand Total	11034	8415	19449

Source: GALI Data; Author calculations

According to the EDP (GALI, n.d.), the entrepreneur support programmes met the following requirements:

- Was an accelerator, incubator, or provided direct support and guidance to entrepreneurs
- Had a written application process
- Selected a cohort of participants while it rejected other applicants
- Provided direct, hands-on support to entrepreneurs for a period shorter than one year (this did not include on-going, maintenance support)

3.4 Empirical model

A preliminary analysis for sample selection bias was performed, which confirmed that no sample selection bias was evident. As the sample selection bias test was preliminary, the results have not been reported. After the test for sample selection bias, a multiple linear regression

was used to analyse the effect of participation in incubator programmes on performance of SMMEs in South Africa. The dependent variables were used to measure the level of firm performance over the period of study in terms of change in revenue, change in employees and change in external financing, being outside equity, debt or philanthropic investment. The main independent variable of interest was if the firm either finished or did not finish the accelerator or incubator programme. Using these inputs, the regression model's equation was as follows:

$$Performance_i = \beta_0 + \beta_1 Incubatorparticipation_i + \beta_2 control_i + \varepsilon_i$$

Where: i represented the firms; *Performance* represented a vector of firm performance which consisted of either revenue, employees, equity financing, debt financing or philanthropic financing; *Incubatorparticipation*, was a binary indicator that denoted participation or non-participation in an incubator; *control* was a vector of control variables discussed further below in Table 3.2.

Table 3.2: Empirical model variables

	Variable	Responses available
Dependent Variables (Performance)		
1	Revenue	South African Rand
2	Employees	Number of employees
3	Equity investment	South African Rand
4	Debt investment	South African Rand
5	Philanthropy investment	South African Rand
Independent Variable		
1	Incubator participation	Defined as 1 if the venture finished or attended any other accelerator program; otherwise, zero (0)
Control Variables		
2	Venture age	The age of the venture in years
3	IP status	Defined as 1 if the firm has intellectual property (either a patent, trademark or copyright); otherwise, zero (0)
4	Founder investment since inception	South African Rand
5	Highest level of education for any founder	Defined as 0 for secondary; 1 for Tertiary; and 2 for Tertiary PhD
6	Highest level of work experience role for any founder	Defined as 0 for Support Staff/ Other; 1 for Senior Management; and 2 for CEO/ Executive Director
7	Age of founder 1	The age of founder 1 in years at application date
8	Gender of founder 1	Defined as 1 if male; otherwise 0

3.5 Description of variables in the multiple regression analysis

All financial values provided by GALI such as revenue and financing were provided in US Dollars (USD). The author converted the US Dollar values to South African Rand (ZAR) values and eliminated the potential effect of currency fluctuations. The exchange rate used to convert the values from USD to ZAR was either the rate on the 1st of January or the 1st of July (or the first business day after those dates). The USD/ ZAR exchange rate values were obtained from the South African Reserve Bank website (South African Reserve Bank, n.d.). The 1st of January was used if the application was made between January and June and the 1st of July rate was used if the application was made between July and December, with follow-up exchange rate conversions made on the same basis (for example follow-up data collected between July and December converted at the 1st of July exchange rate).

3.5.1 Dependent variables

Each of these dependent variables were considered to be objective measures of performance which were not subject to bias.

3.5.1.1 Revenue

A firm's revenue was collected at the application point and the follow-up point. Revenue collected at the follow-up point was used in the study. Follow-up revenue related to the preceding calendar year. For example, if a firm applied in 2013, follow-up data was collected in 2014 for revenue in the 2013 calendar year. Revenue was used as a financial performance indicator to determine if firms that finish an accelerator programme have improved financial performance, measured by higher revenues, compared to firms that do not finish accelerator programmes. According to Dvouletý et al. (2018) and Löfsten and Lindelöf (2002), revenue is a good financial performance indicator for new firms as revenue is an important factor for long-term viability to sustain operations as it increases internal financial resources. Firms that finished accelerator programmes were expected to have higher revenue than firms that did not, as accelerators were expected to increase firm financial performance. The time-frame between application and follow-up date was relatively short, approximately 18 months. Lukeš et al. (2019) found that effect of business acceleration differed over shorter and longer periods (after 3 or 4 years). For this reason, the study investigated other measures of performance such as employment growth and external financing. Lerner (2000) used employment and sales growth

as a measure of performance for private firms as a proxy for firm valuations – the findings indicated that higher sales and employment growth supported higher valuations.

3.5.1.2 Employment

At the follow-up data collection point, the number of employees (excluding founders) that worked for the firm on 31 December of the most recent year was counted. Employment was used as a performance indicator to determine if firms that finished an accelerator programme performed better than firms that did not. Löfsten and Lindelöf (2002) indicated that employment growth and sales growth lead to increased firm resources, which confirmed that employment was a valid indicator of firm performance. Dvouletý et al. (2018) indicated that employment was potentially more effective than revenue as a performance measure over short periods. This was because revenue and other financial measures could be volatile over shorter periods. Colombo and Delmastro (2002), Peña (2004), and Stokan et al. (2015) all used employment to test the effect of incubation on firm performance. The South African Government's goal of creating jobs via SMMEs was another reason to test if accelerators increased the number of employees. Employment numbers were expected to increase for firms that were incubated compared to non-incubated firms.

3.5.1.3 Equity investment

At the follow-up collection point, the amount of equity investment a firm received in the preceding calendar year was collected. For example, if a firm applied in 2013, the follow-up collection point would have been in 2014 for the amount of equity investment received during the 2013 calendar year.

3.5.1.4 Debt investment

At the follow-up collection point, the amount of debt investment a firm raised in the preceding calendar year was collected. For example, if a firm applied in 2013, the follow-up collection point would have been in 2014 for the amount of debt investment raised during the 2013 calendar year.

3.5.1.5 Philanthropic investment

At the follow-up collection point, the amount of philanthropic donations received in the preceding calendar year was collected. For example, if a firm applied in 2013, the follow-up collection point would have been in 2014 for the amount of philanthropy raised during the 2013

calendar year. External investment (Equity, Debt, Philanthropic) was used to determine if firms that finished an accelerator programme received more external funding compared to firms that did not finish an accelerator programme. Rothaermel and Thursby (2005) found that financing was a better performance indicator than revenue for young firms in the technology sector. Lerner (2000) postulated that if receiving an SBIR award (equivalent to being accepted onto an accelerator programme as in this study) was a signal to external funders such as venture capitalists, then awardee firms were expected to receive more venture capital financing compared to non-awardees. Cumming and Fischer (2012) found that business advisory services, provided to growth oriented SMMEs, was positively related to angel equity financing. Therefore, based on these prior studies, incubated firms were expected to show more external financing compared to non-incubated firms. The completion and acceptance into an accelerator could have been a signal to external finance providers to minimise information asymmetries and perception of risk. In addition, InfoDev (2010) discussed that incubators often received grants or philanthropic financing from public sources for incubator costs and to provide grants or donations to incubated firms for research and development.

3.5.2 Independent variables

3.5.2.1 Finishing an accelerator programme

The empirical model assigned a dummy variable to this variable with 1 = firm completed the accelerator programme and 0 = firm did not complete the accelerator programme. For the purpose of this study, accelerator participation was the main variable of interest to understand how it affected firms' performance. It was expected that finishing an accelerator programme would result in increased firm performance measured by higher revenue, higher employment, and increased equity, debt and philanthropic investment. Firm performance was expected to increase due to various factors such as strengthened business networks, access to financial capital, improved owner or management knowledge and skills, and access to improved resources or resources at a lower cost. There were numerous studies to test the effect of incubation on firm performance such as Stokan et al. (2015) who found that incubated firms performed better than non-incubated firms and received up to five times more business services or access to resources. They contended that the increased access to services was due to enhanced networking opportunities within the incubator. Colombo and Delmastro (2002) showed that incubated NTBFs were able to access public funds easier than non-incubated firms. Peña (2004) and Li et al. (2020) argued that management training and assistance services, which were generally provided by incubators, were positively associated with firm

performance. Cumming and Fischer (2012) found that advising hours (which could have been analogous to duration or number of accelerator programmes completed) significantly affected sales and financing performance.

3.5.2.2 Venture age

The age of the firm is measured in years between the founding year and year of application to the accelerator. Firm age was relevant to this study as it indicated the level of the firm's operating experience. Organisational learning theory supported the notion that greater experience and knowledge, which had been created, retained and transferred over time, influenced firm performance (Calantone, Çavusgil, & Zhao; and Argote as cited in Adamu, 2019). Coad, Holm, Krafft, and Quatraro (2018) argued that causality ran from firm age to improved performance as performance cannot influence age. Coad et al. (2018) postulated that performance was influenced by age due to "routinization [sic], accumulated reputation and organizational [sic] rigidity" (p. 5) which was likely as a result of learning effects. Abor and Biekpe (2006) found that larger, older firms were likely to have easier access to debt financing as they were less risky. Interestingly though, Thornton and Belski (2010) found that the age of a non-profit firm did not impact the amount of donations it receives. In this study, it was expected that older firms would display improved revenue and employment performance figures. The expected increase in firm performance should have resulted in an expected increase in external equity and debt financing, whereas firm age was not expected to have an effect on philanthropic financing.

3.5.2.3 Intellectual property

In this study, intellectual property was classified as either a patent, copyright or trademark. A dummy variable was used to identify if the firm had intellectual property prior to applying to the accelerator programme. The dummy variables were either the firm had intellectual property at the application stage = 1 or the firm did not have intellectual property at the application stage = 0. Intellectual property was used as an independent control variable in the study as intellectual property was likely to impact firm performance. In the biotechnology sector, firms with intellectual property, such as patents, were more likely to obtain additional financing increasing their chances of survival (Baum & Silverman, 2004). In a study on innovativeness and start-up survival rates, Hyytinen, Pajarinen and Rouvinen (2015) highlighted a number of studies, across different industries and countries, that showed that intellectual property (or innovativeness) increased the probability of firm survival. The presence of intellectual property

was expected to positively impact revenue, employment, external equity and external debt financing. The study expected no relationship between intellectual property and philanthropic financing.

3.5.2.4 Founder investment

The control variable, founder investment, was the value of the founders' investment into the firm, in South African Rand, since inception. Peña (2002) found that firms that have more financial capital when started were more likely to survive for longer. Peña (2002) also found that entrepreneurs of growing firms invested more in their businesses, and that approximately 60% of these firms were funded with personal savings. Stam and Garnsey (2007) argued that higher levels of start-up capital allowed firms to invest in resources that enabled growth, and acted as a buffer against external shocks. Therefore, when founders increased the amount of financial resources available by making a capital investment, it was likely to improve the firm's survival chances and ability to grow. Increased founder investment was expected to lead to higher levels of revenue and employment as well as increased equity and debt financing. No interaction with philanthropic financing was expected.

3.5.2.5 Founder education

Founder education was an independent control variable for the empirical model. The study used dummy variables to indicate the highest level of education attained by either of the three founders as per the GALI survey. Dummy variables were used for secondary education = 0 (which consisted of middle school or high school), tertiary education = 1 (which consisted of graduate, vocational, bachelors, honours, associate and master's degrees), and tertiary education = 2 (which consisted of PhDs).

In their study of SMME access to debt finance in Ghana, Abor and Biekpe (2006) theorised that entrepreneurs with higher academic qualifications would have greater access to debt financing. They, however, found that highly educated entrepreneurs depended less on debt and more on equity (Abor & Biekpe, 2006). Peña (2004), however, found that entrepreneurs who were more educated, had more managerial experience, and capitalised on ideas from previous jobs, were more likely to create a successful company. This supported the theory of human capital that entrepreneur talent, experience and motivation determined the level of firm success (Peña, 2004). It also confirmed Honig's findings that an owner's human capital, measured as formal education, positively impacted firm profitability (Peña, 2004). These findings,

therefore, suggested that the education levels of the founders were likely to impact revenue, employment and financing performance. Revenue, employment and equity financing were expected to be positively related to education levels, whereas debt financing was expected to be negatively related, as per Abor and Biekpe (2006), and philanthropic financing was expected to have no relationship to for-profit firms.

3.5.2.6 Founder experience

Founder experience was an independent control variable for the empirical model. The study used dummy variables to indicate the highest level of work experience attained by either of the founders in their last two roles. Dummy variables were used for Support Staff or Other = 0, Senior Management = 1, and CEO/ Executive Director = 2.

In their analysis of the role that venture capital firms played in the performance of biotechnology start-ups, Baum and Silverman (2004) highlighted Zacharakis and Meyer's findings that the skills and experience of management teams were important selection criteria for venture capital firms. In a literature review by Hyytinen et al. (2015), it was found that entrepreneurs with more management and industry experience positively impacted a firm's likelihood of survival. Furthermore, founder experience was considered to be a contributing factor of human capital theory which explained that entrepreneur talent, experience and motivation determined the level of firm success (Peña, 2004). Therefore, the level of founder experience was likely to positively impact all dependent variables except for philanthropic financing which should have had no relationship with for-profit firms.

3.5.2.7 Founder age

Founder age was the age in years of the founder identified as Founder 1 in the GALI survey. Founder age was used as an independent control variable for the empirical model. A literature review by Hyytinen et al. (2015) found that a firm's likelihood of survival was enhanced by the entrepreneur's age, education, and experience. Ouimet and Zarutskie (2013) argued that firms created with a larger share of young employees were more likely to raise venture capital financing. However, Peña (2002) noticed that older entrepreneurs accumulated more business experience and market knowledge, which was important to ensure firm survival. The findings indicated that founder age would have likely affected the dependent variables. This study, therefore, controlled for the effect of founder age on firm performance and used founder age as a control variable

3.5.2.8 Founder gender

Founder gender was used as an independent control variable for the empirical model. Founder gender was the gender of Founder 1 in the GALI survey. Dummy variables were used with female = 0 and male =1. Garwe and Fatoki (2012) found that there was no gender discrimination in assessing the availability of debt finance for SMMEs. There was, however, factors that discouraged females from applying for credit. This complemented Abor and Biekpe (2006), who suggested that female-owned SMMEs were significantly less likely to employ debt finance. Hyytinen et al. (2015) found that the gender of an entrepreneur mattered for firm survival prospects. Stam and Garnsey (2007) also found that gender (female) was negatively correlated with firm growth. As a result of these findings, it appeared that gender would have affected the dependent variables and this study, therefore, used gender as a control variable.

3.6 Estimation techniques

The author tested if selection bias was evident using a Heckman two-stage least squares test, as only firms that were aware of, and applied to incubators were included in the dataset. The data did not include firms that did not apply to incubators. The results of the Heckman two-stage least squares test was not statistically significant, which indicated that selection bias was not evident. This allowed the author to perform a multiple regression, ordinary least squares (OLS) cross-sectional analysis.

The results of the OLS regression models are disclosed in Table 4.5. Similar models were used by Odei and Novak (2020) and Seroka (2018). The Odei and Novak (2020) model was used to test the factors that contributed to innovation (measured by sales) in SMMEs in Europe. Seroka (2018) used the OLS regression model to examine how debt structure affected South African SMMEs profitability.

OLS is a linear regression model that, “estimates of the intercept and slopes that minimize [sic] the sum of the squared differences between the observed values of the dependent variable and the values predicted based on the regression model” (SAGE Research Methods Datasets, 2015, p. 4). OLS was used because the analysis was a cross sectional study and the dependent variable was a continuous variable. A linear relationship between incubator participation and performance was expected.

Diagnostic tests were performed. A multicollinearity test was performed to ensure that the independent variables did not show high levels of correlation, the results for the multicollinearity test are shown in Table 4.4. A test for heteroskedasticity (using the Breusch-Pagan/Cook-Weisberg test) was performed to determine if the variance of the error terms was constant. The results for the heteroskedasticity test are disclosed in the regression output in Table 4.5 (Hetttest χ^2 ; Prob > χ^2). The results indicated that heteroskedasticity was not present in the error terms for the revenue or employment models.

An analysis of variation (ANOVA), or an F-test, was performed to test the explanatory power of each model and if the independent variables were linearly related to the dependent variables, the findings are disclosed in Table 4.5. In other words, it tested if there was a linear relationship between the firm's performance (measured by revenue, employment, equity finance, debt finance or philanthropic finance) and the independent variable such as incubation participation. Similarly, the adjusted R-Square was calculated to determine the percentage of variation in performance that was measured and explained by the regression model.

3.7 Limitation

The analysis was unable to determine the quality of each accelerator and there was no variable to identify the types of services provided by each accelerator. Data was collected from entrepreneurs who applied to entrepreneur support programmes that met the requirements for the EDP. The database, therefore, only consisted of firms or entrepreneurs who applied to entrepreneur support programmes and was not a complete reflection of the entire population of SMMEs in a particular country. Two distinct groups were present in the data however – firms that completed the accelerator or entrepreneur support programme and firms that were not accepted into the programmes. The group that was not accepted into the programme was used as the control group, however, the control group could not be considered as a proxy for the general population of SMMEs, rather it was a proxy for SMMEs that were aware of accelerators and applied to them, but were not accepted onto the programme. In addition, the database and analysis was unable to determine the quality of each accelerator and there was no variable to identify the services provided.

3.8 Summary of methodology

This chapter provided the research methodology used in the study. The chapter explained why a quantitative research approach was used. The research design, which was cross-sectional in

nature, and the linear regression statistical analysis technique was discussed. Detail about the source and characteristics of the research data was provided and the empirical regression model used for the analysis was described. The chapter provided a detailed discussion of the dependent and independent variables used in the study, while providing supporting evidence for including each variable in the study. Finally the estimation techniques and study limitations were discussed. The following chapter will discuss the findings of the study.

Chapter 4: Discussion of Findings

4.1 Introduction

The chapter discusses the findings of the statistical analysis performed on the data. The author discusses what the findings mean and the implications thereof. The data is used to analyse the relationship between being an incubator participant and SMME performance. Performance is measured by revenue, the number of employees, equity investment, debt investment and philanthropic support. The implications of the findings are discussed. The chapter is made up of five subsections: discussion of performance indicators, descriptive statistics, test for multicollinearity, the results of the regression, and chapter conclusion.

4.2 Business incubation and SMME performance indicators

The performance indicators in Table 4.1, below, show descriptive statistics for each dependent variable at the follow-up stage (time = t). The dependent variables are revenue, employees, equity financing, debt financing and philanthropic financing. Revenue, equity financing, debt financing and philanthropic support were measured in South African Rand. Employees is measured as the sum of full-time and part-time employees. The output provides descriptive statistics grouped by the main variable of concern, participation in an incubator (incubation sample) and no participation in an incubator (no incubation sample). The descriptive statistics presented in the table are the mean, standard deviation (Std Dev), minimum (Min), maximum (Max), and number of data points (Count).

The performance indicators highlight that the mean revenue for the no incubation sample was R2,2 million per firm, whereas the mean for the incubation sample was R1,5 million per firm. In addition to the higher mean, the no incubation sample had a higher maximum revenue of R53,1 million and a higher standard deviation of revenue. The lower average revenue for incubated firms may be that incubated firms are more niche and technologically advanced; therefore, they have yet to generate significant revenue as discussed by Dvouletý et al. (2018).

Comparing the average number of employees of the no incubation sample to the incubation sample, the incubation sample on average had 12.3 full-time and part-time employees, compared to 7.4 employees for firms in the no incubation sample. Standard deviation and maximum employees is higher in the incubation sample.

Non-incubated firms on average raised R8,450 in equity finance from external parties (in the 12 months before the follow-up data collection point). This is lower than the average raised by incubated firms who, on average, raised R335,251 from external equity providers. The incubation sample has a higher standard deviation of R1,88 million and maximum equity finance raised of R15,9 million compared to the non-incubated sample.

Moving to debt raised, it appears that non-incubated firms compensated for the lower equity financing with a higher average amount of debt raised. On average, the no incubation sample raised R1,02 million in debt compared to R153,228 debt raised for incubated firms. The standard deviation of debt raised for the no incubation sample was higher than the incubation sample. In addition, the maximum value of debt raised for the no incubation sample was almost ten times higher than the incubated sample (R81,8 million compared to R8,8 million). The average philanthropic support provided to non-incubated firms was R141,736 which was lower than the R249,189 average provided to incubated firms. Standard deviation and maximum is higher in the incubation sample.

Table 4.1: Performance indicators and incubator status

	Total revenue	Employees	Equity Finance	Debt	Philanthropic support
No Incubation Sample					
Mean	2 223 734	7.406977	8 450.619	1 024 638	141 736.2
Std Dev	8 016 125	11.91379	60 291.89	8 827 505	648 182.4
Min	0	0	0	0	0
Max	53 100 000	75	549 016	81 800 000	5 306 556
Count	86	86	86	86	86
Incubation Sample					
Mean	1 521 019	12.27083	335 251.1	153 228.3	249 189.5
Std Dev	5 537 243	38.07319	1 879 271	1 000 645	1 044 717
Min	0	0	0	0	0
Max	41 900 000	300	15 900 000	8 809 800	9 216 288
Count	96	96	96	96	96

Source: Researchers estimate from research data

4.3 Descriptive statistics

Table 4.2 and Table 4.3, below, shows the descriptive statistics for all the regression variables including the control variables (Venture Age, IP Status, Founder Investment, Founder Education, Founder Experience, Founder Age, Founder Gender). The average revenue for the

entire sample was R1,853,071. On average, each firm in the sample employed 9.97 employees and raised R180,829 in equity finance. For the sample, the average debt raised and philanthropic support was R564,993 and R198,415, respectively. The mean for incubator attendance, the main independent variable, indicates that, of the entire sample, 52.7% of the firms attended an incubator programme. The average age of the founders were 34 years at the time of the application with the youngest and oldest founder being 21 and 74 years old, respectively. Approximately 70% of the founders were male. On average, 34% of the firms had some sort of intellectual property at the time of the accelerator application.

Table 4.2: Descriptive statistics of regression variables

Stats	Mean	Std. Dev.	Min	Max	N
TREV (R)	1853071	6811249	0.000	53100000	182
EMPLOYEES	9.972527	28.86881	0.000	300	182
EQUITY (R)	180828.9	1371899	0.000	15900000	182
DEBT (R)	564993.4	6108223	0.000	81800000	182
PHILANTHROPY (R)	198414.9	879232	0.000	9216288	182
INCUBATOR	0.527	0.501	0.000	1.000	182
VENTURE AGE (YEARS) IN 2020	6.346	3.781	2.000	38.000	179
IP STATUS	0.341	0.475	0.000	1.000	182
FOUNDERS INVESTMENT	6.462	4.513	0.000	13.487	182
FOUNDERS AGE (YEARS)	34.378	9.715	21.000	74.000	180
GENDER (MALE)	0.699	0.460	0.000	1.000	176

Source: Researchers estimate from research data

Table 4.3 indicates the distribution of the founders' levels of education and their levels of experience. The highest proportion of founders, 79.8%, had tertiary education with 43.8% having either experience as a CEO or Executive Director.

Table 4.3: Descriptive statistics of founder education and founder experience

	Category	Freq.	Percent
Education	Secondary	29	17.26
	Tertiary	134	79.76
	PhD	5	2.98
	Total	168	100
Founders experience	Support Staff/ Other	67	38.07
	Senior Management	32	18.18
	CEO/Executive Director	77	43.75
	Total	176	100

Source: Researchers estimate from research data

4.4 Test for multicollinearity

When independent variables are correlated with each other, multicollinearity is present. The presence of multicollinearity between independent variables is a problem as it inflates the sampling errors and, therefore, the variance of the sample coefficient (Keller, 2015). This may result in an incorrect predictor of the population parameter. Another problem is that multicollinearity could lead to the incorrect conclusion that there is no linear relationship between the dependent and independent variables (Keller, 2015).

Variance inflation factors (VIF) are used to quantify the severity of multicollinearity in an OLS regression analysis (Alibuhtto & Peiris, 2015). Table 4.4, below, shows the VIF for the regression models (only one VIF output is required for all models as the independent variables are consistent). A VIF value greater than five indicates that the relevant coefficient is poorly estimated because of multicollinearity (Montgomery as cited by Alibuhtto & Peiris, 2015). The results of the VIF calculations indicate that multicollinearity is not a concern for the study's regression models as the VIF for all independent variables are below five. There is no significant level of correlation between the independent variables, i.e. there is a lack of multicollinearity present.

Table 4.4: Variance inflation factors

Variable VIF	VIF	1/VIF
INCUBATOR	1.08	0.927712
VENTURE AGE	1.16	0.863098
IP STATUS	1.08	0.929469
FOUNDERS INVESTMENT	1.13	0.883466
EDUCATION (SECONDARY)		
MASTERS	1.13	0.888326
PHD	1.16	0.865196
FOUNDERS EXPERIENCE (SUPPORT STAFF)		
SENIOR MANAGER	1.42	0.706437
CEO	1.46	0.682859
FOUNDERS AGE	1.35	0.741021
GENDER (MALE)	1.1	0.908344

Source: Researchers estimate from research data

4.5 Test for heteroskedasticity

A test was conducted to confirm if the variance of the error terms were constant. The test, a Breusch-Pagan/Cook-Weisberg test for heteroskedasticity, found that the revenue and employment models did not indicate that the variance of the error terms were heteroskedastic. The p-value of test statistic was above 0.1 for revenue and employment indicating that the null hypothesis of homoskedasticity could not be rejected at the 5% level of significance. The null hypothesis indicated that the variance of the error terms were homoskedastic. On the contrary, the null hypothesis of homoskedasticity was rejected in the equity, debt and philanthropy models, hence, the three models were estimated with heteroskedastic consistent errors.

4.6 Regression results

The outputs of the regression models are presented in Table 4.5 (page 56). As discussed in the previous chapter, the multiple linear regression models were estimated using ordinary least squares (OLS), in a cross-sectional analysis. Five regression models were generated for the five dependent variables. To normalise the distribution of the dependent variables, the output was transformed by the natural logarithm. The aim of the analysis was to determine the effect of accelerator participation on the performance of revenue (TREV), employment (EMPLY), equity finance (EQTFIN), debt finance (DEBT) and philanthropic finance (PHIL).

Table 4.5 shows the regression models for each dependent variable and the diagnostics for each model. To test the validity of each model, diagnostics were performed using the F-statistic and the corresponding p-value. If the F-statistic is sufficiently large, the corresponding p-value should be small indicating that the model has validity because at least one of the independent variables is linearly related to the dependent variable (Keller, 2015). The TREV and EMPLY models were valid at the 1% significance level. The PHIL model was valid at the 5% significance level. The EQTFIN and DEBT models lacked validity, which indicated that there was no linear relationship between the dependent and at least one of the independent variables for those models.

The adjusted R-square (or Coefficient of Determination) assesses the percentage of variation in the dependent variable that is explained by the independent variables (Keller, 2015). This statistic helps to identify the level of variation that the model does not account for in the dependent variable. The adjusted R-square for each model was below 25%, indicating that the models had low explanatory power for performance. In the TREV model, 11.45% of the variation in revenue was explained by the variation in the independent variables. In the EMPLY model, 22.12% of the variation in the number of employees was explained by the variation in independent variables. The philanthropic finance model, PHIL, indicated that the independent variables explained 4.23% of the variation in philanthropic financing. As the EQTFIN and DEBT models lack validity, it is understandable that the model for EQTFIN and DEBT explained insignificant variation in the dependent variables at -0.55% and 0.56%, respectively. The model for employment, therefore, had the highest explanatory power, indicating that the independent variables of the model are more likely to explain changes in employment performance compared to the other models. Peña (2004) had a similar experience in that the explanatory power for the performance on employment was higher than the explanatory power for the performance on sales.

4.6.1 Revenue model

The revenue regression model was significant at the 1% level. This indicated that at least one of the independent variables had a linear relationship with revenue. The adjusted R-square was 11.45% which meant that 11.45% of the variation in revenue was explained by the independent variables.

According to this model, completing an accelerator programme had a negative relationship with revenue performance. The relationship implied that completing an accelerator programme resulted in a decrease in revenue at the follow-up period. However, there was no sufficient evidence to conclude that there was a linear relationship between completing an accelerator programme and revenue performance. The negative effect of incubator attendance on revenue performance was not expected and did not confirm the results of Cumming and Fischer (2012), who found that increased advising hours increased revenue and financing performance. Similarly, it contradicted Autio and Rannikko (2016) who found that participation in the NIY Programme increased revenue growth. The NIY Programme, however, also provided financial support which was not the same as in this study. The finding for the revenue model did, however, confirm the findings of Ensley and Hmieleski (2005); Dvouletý et al. (2018) as well as Lukeš et al. (2019). Lukeš et al. (2019) indicated that revenue growth was negative in the short-term but turned positive after 3 or 4 years. Their finding were relevant in this study as the longest period between the initial data collection point and follow-up collection was 18 months. The short-term of the study might have been the reason for the negative impact on revenue due to incubation.

The model found that venture age had a positive relationship with revenue, older ventures were found to have higher revenue on average. The relationship was statistically significant at the 10% significance level, which inferred that there was a linear relationship. This finding was supported by organisational learning theory which explained that firms with longer operating histories performed better due to increased experience and knowledge (Calantone, Çavuşgil, & Zhao; and Argote as cited in Adamu, 2019). The finding was also consistent with Coad et al. (2018) who found that performance increased with age due to accumulated knowledge, reputation and improved routines.

The relationship between revenue and intellectual property (IP status) was negative. IP status was a dummy variable. A firm that had intellectual property, had lower revenue. The finding was not statistically significant; however, and a linear relationship between the presence of IP and revenue could not be inferred. These findings contradicted the Baum and Silverman (2004) study that intellectual property in biotechnology firms increased financing and survival. Additionally, this finding did not support the resource based theory discussed in Tembe (2018), which argued that firms create economic value by effectively managing their resources (such as intellectual property).

Founder investment was found to have a positive relationship with revenue. This meant that firms with higher founder investment had higher revenue. The relationship had statistical significance at the 5% significance level. This finding corroborated the financial capital theory supported by Li et al. (2020) who found that financial capital positively supported business and entrepreneurial development. Increased start-up capital due to founder investment was also found to support growth by Stam and Garnsey (2007). This study, therefore, corroborated those findings.

If one of the founders had a tertiary qualification (coded as 'Masters'), then the relationship with revenue was positive. This effect was not statistically significant. If one of the founders had a PhD qualification, the effect on revenue was positive; firms with a PhD founder were likely to have higher revenue. The result was statistically significant at the 1% significance level. The finding that PhD founders had higher revenue supported the theory of human capital, that performance increased with education and training, which was confirmed in Peña (2004).

The relationship between revenue and a founder with senior management experience was positive. There was insufficient evidence to infer a linear relationship between a founder's senior management experience and increased revenue. Having a founder with previous CEO experience had a positive effect on revenue with statistical evidence at the 5% significance level. This finding was once more supported by the theory of human capital that increased education, training and experience resulted in improved performance as discussed in Peña (2004). In addition, resource based theory explained that experienced managers, such as CEOs, were more likely to catalyse firm resources into new services and products which produced growth (Tembe, 2018).

Founder age had a negative relationship with revenue, which implied that firms with older founders were likely to have lower revenue. This finding contradicted Peña (2002) who found that older entrepreneurs were instrumental in firm survival and, therefore, likely growth. The effect of founder age was, however, statistically insignificant to infer a linear relationship.

Similarly, the relationship between a male founder and revenue was positive, which was supported by the findings of Stam and Garnsey (2007) that gender (being female) was negatively correlated with firm growth. The positive relationship was found to be statistically insignificant, however.

4.6.2 Employment model

According to the F-statistic and corresponding p-value, the regression model for employment was significant at the 1% level, which indicated that at least one of the independent variables had a linear relationship with employment and the model was considered valid. The adjusted R-square indicated that 22.12% of the variation in the number of employees was explained by the independent variables.

The relationship between firms that completed an accelerator programme and the number of employees was positive. This meant that firms that completed an accelerator had more employees than firms that did not complete an accelerator. The finding confirmed Colombo and Delmastro (2002) as well as Löfsten and Lindelöf (2002) who showed that incubated firms were able to increase the number of employees more quickly than non-incubated firms. The relationship was not, however, statistically significant to conclude that programme completion was linearly related to employment.

Venture age had a positive relationship with employment. An increase in venture age was found to increase the firm's number of employees. The effect of venture age on employees was statistically significant at the 1% significance level. Therefore, the author could infer that there was a linear relationship between venture age and number of employees. The finding confirmed the organisational learning theory, that greater experience and knowledge caused increased performance which likely required more employees (Argote; and Calantone, Çavusgil, & Zhao as cited in Adamu, 2019; Coad et al., 2018).

The relationship between intellectual property (IP status) and employment was negative as with the revenue model. Therefore, a firm with IP was likely to have fewer employees than firms without IP. This finding did not support the resource based theory as discussed by Tembe (2018), which stated that firms with greater access to resources, such as IP, would perform better. The relationship was not statistically significant and a linear relationship could not be inferred.

Founder investment was found to have a positive relationship with the number of firm employees. An increase in the investment made by a founder, increased the number of employees at the firm. The relationship was statistically significant at 1% level of significance,

which indicated that there was a linear relationship between founder investment and the number of employees. This finding was similar to the findings in the revenue model and confirmed that more start-up capital resulted in increased growth (Stam & Garnsey, 2007).

There was a marginal negative relationship between the presence of a founder with a tertiary qualification (Masters), and the number of employees at a firm. There was no statistical evidence to infer that the relationship was linear. If one of the founders had a PhD qualification (PhD), the relationship to the number of employees was positive and there was statistical evidence to confirm a linear relationship at the 5% significance level. Findings of higher levels of human capital was again confirmed by Peña (2004) that more educated founders had more successful companies.

The relationship between the number of employees and having a founder with senior management experience was positive. However, the relationship was not statistically significant. The relationship between employees and a founder with CEO experience was even more positive. If a founder was a previous CEO, a firm would likely have had more employees. This relationship was statistically significant at the 5% significance level and once more confirmed the theory of human capital as per Peña (2004).

Founder age had a slightly positive relationship with employees. A founder that was older was likely to have more employees. The effect of founder age was statistically insignificant to infer a linear relationship. Interestingly this was different to the findings in the revenue model that indicated that an increase in founder age had a negative relationship with revenue. If more employees were associated with firm survival then this finding was supported by Peña (2002) in that older entrepreneurs positively impacted firm survival chances.

If the first reported founder was a male, there was a positive relationship with the number of employees, indicating that firms that had a male founder had more employees. The relationship was found to have a statistically significant linear relationship at the 5% level. The findings of Stam and Garnsey (2007) corroborated findings in this study as female founded firms were negatively correlated with firm employment growth.

4.6.3 Equity finance model

The equity finance model was considered invalid, confirmed by the p-value of the F-statistic not being statistically significant at the 5% level. This implied that most of the variation in equity financing was not explained by the model. This finding was confirmed by the low adjusted R-square of -0.55%. This finding did not support the claims put forward by Dvouletý et al. (2018) and Rothaermel and Thursby (2005) that external investment would be a better indicator of firm performance than revenue or the number of employees. As a result of the model's invalidity, none of the independent variables were found to have a statistically significant linear relationship with the amount of equity finance raised.

The relationship between equity finance and incubator participation was positive, which confirmed findings that incubated NTBFs were able to access financing easier than non-incubated firms (Colombo & Delmastro, 2002). These findings also supported the work of Cumming and Fischer (2012) and the social capital and network theory that increased support or stronger networks were positively related to raising capital and firm performance.

Venture age and founder age had negative relationships with equity finance which meant that an increase in venture age or founder age lowered the amount of equity finance raised. Surprisingly, this supported Ouimet and Zarutskie (2013) who argued that firms with more young employees (and likely younger founders) found it easier to raise venture capital financing, which is equity financing.

The presence of IP lowered the amount of equity finance raised. This contradicted the Baum and Silverman (2004) study that intellectual property in biotechnology firms increased financing and survival.

Founder investment was found to have a positive relationship with equity financing as with revenue and employees. This supported capital structure theory that firms would minimise distress costs of excess debt, and raise more equity financing.

Higher levels of education had a positive relationship with equity financing raised which confirms the findings of Abor and Biekpe (2006), that entrepreneurs with higher academic qualifications depended less on debt and more on equity.

Increased levels of experience and, specifically, previous CEO experience had a positive impact on external equity funding raised. This corroborated the findings of Baum and Silverman (2004) that venture capital firms preferred founders with significant skill and experience before investing in a firm.

It was found that being a male founder had a positive relationship with equity finance which indicated that male founded firms were more likely to raise funding than female founded firms. This finding was different to Garwe and Fatoki (2012) who found that there was no gender discrimination for the availability of debt finance for SMEs. Therefore, based on these two studies, it appeared that there was gender bias in equity financing but not for the availability of debt financing.

4.6.4 Debt finance model

As with the equity finance model, the debt finance model is invalid. The p-value of the F-statistic is not statistically significant at the 5% level. Therefore, most of the variation in debt financing is not explained by this model as none of the independent variables are linearly related to debt financing. The model's invalidity is confirmed by a low adjusted R-square of 0.56%. The adjusted R-square means that 0.56% of the variation in debt financing is explained by the independent variables.

Due to the model's invalidity, none of the independent variables have a statistically significant linear relationship with the amount of debt financing raised.

The relationship between debt financing and incubator participation was negative. This indicated that participating in an incubator was related to lower debt financing. This was contrary to Cumming and Fischer (2012) who found that business advisory services was positively related to equity financing. Therefore, based on these studies, incubated firms were expected to show more external financing compared with non-incubated firms. The argument of Stokan et al. (2015) that incubated firms performed better and received up to five times more access to resources was not supported. Additionally, findings by Colombo and Delmastro (2002) that incubated firms were more likely to access public funding, could not be extended to include debt funding.

The relationship between the amount of debt raised and level of working experience was negative. A firm with a founder with either senior management or CEO experience was likely to have lower debt financing, than firms with founders without that experience. This was the only model to produce a negative relationship between experience and performance, contradicting the findings in Peña (2004) which explained that experience determined the level of firm success.

Venture age, as with revenue and employees was found to have a positive relationship with debt financing. This confirmed organisational learning theory, that greater experience, transferred over time, influenced firm performance (Calantone, Çavusgil, & Zhao; and Argote as cited in Adamu, 2019).

IP status was positively related to debt financing which indicated that firms with IP had higher levels of debt financing. This confirmed the Baum and Silverman (2004) theory that biotechnology firms with intellectual property obtained more financing.

The relationship between founder investment and debt financing was positive: increased founder investment resulted in increased debt financing. This was likely due to minimising information asymmetries with which many SMMEs have struggled when raising external funding as explained in Lerner (2000) and Seroka (2018).

As with all other models, founders with a PhD level of education had a positive relationship with the dependent variable, including the level of debt financing. As before, this finding supported the theory of human capital that human performance increases with increased education (Fatoki, 2011).

Debt financing and founder age was found to have a positive relationship. This confirmed the findings in Peña (2002) that older entrepreneurs with more business experience ensured firm survival, likely through increased access to finance.

Being a male founder was positively related to all dependent variables indicating that being male was associated with increased debt funding. This confirmed the findings of Garwe and Fatoki (2012) that females were less likely to apply for debt financing. It also confirmed the

findings of Abor and Biekpe (2006) who suggested that female-owned SMMEs were significantly less likely to employ debt finance.

4.6.5 Philanthropic model

The p-value of the F-statistic for the philanthropic finance regression model was significant at the 5% level. Therefore, the model was valid as at least one independent variable had a linear relationship with philanthropic finance. The adjusted R-square indicated that 4.23% of the variation in philanthropic finance was explained by the variation of the independent variables in the model.

Completion of an accelerator programme and philanthropic finance had a positive relationship, which indicated that completion was associated with increased philanthropic financing. The relationship was statistically significant at the 5% significance level. There was, therefore, statistical evidence to conclude that there was a linear relationship between accelerator completion and philanthropic finance. This supported Cumming and Fischer (2012) that increased advising hours (such as incubation) positively affected sales and financing performance. This was also confirmed by InfoDev (2010), that incubated firms were likely to receive philanthropic financing from public sources.

Venture age had a positive, statistically significant relationship with the dependent variable. The relationship was significant at the 10% level, which meant that there was a linear relationship between venture age and philanthropic finance. An increase in venture age was associated with an increase in philanthropic finance and also supported the organisational learning theory as discussed by Adamu (2019).

The remaining independent variables did not exhibit a statistically significant linear relationship with philanthropic finance. IP status had a negative relationship, which implied that the presence of IP was related to lower levels of philanthropic financing, disproving the findings that firms with IP in the biotechnology sector were more likely to obtain external financing (Baum & Silverman, 2004).

Founder investment, tertiary qualification (Masters), PhD qualification, senior management experience, CEO experience and the male gender all had a positive relationship with philanthropic finance.

An increase in founder investment was associated with increased philanthropic finance as well as increased levels of revenue, employees and external debt and equity financing. These findings supported the resource based theory that increased access to resources (Dvouletý et al., 2018) allowed firms to outperform other firms, which potentially included the ability to raise philanthropic financing.

Firms with founders who had a PhD qualification had higher revenue, employees and all types of external financing. This finding strongly supported the theory of human capital that performance increased with education and training (Fatoki, 2011), and that firms started by founders with higher levels of education were more likely to start successful companies (Peña, 2004).

Similarly to founder education, founder experience, particularly founders with CEO experience, also had a positive relationship with raising philanthropic financing. This is also confirmed in human capital theory by Peña (2004).

Being a male founder increased philanthropic finance in the same way as all other measures of performance increased due to a male founder. This confirmed the thesis of Hyytinen et al. (2015) that founder gender was important for the prospects of survival.

Founder age had a negative relationship with philanthropic financing indicating that an older founder likely received less philanthropic finance. This was similar to the findings of Ouimet and Zarutskie (2013) who argued that firms with more young employees (and likely founders) were able to raise more external venture capital (equity) financing.

4.7 Summary of findings

The chapter discussed the findings of the statistical analysis performed on the GALI data. The chapter started by comparing the descriptive statistics of the study's dependent variables which had been grouped by the main variable of interest, incubator participation. Descriptive statistics, specifically the mean, standard deviation, minimum, maximum and number of observations were then shared for all variables on a consolidated basis. Findings of the tests for multicollinearity and heteroskedasticity were provided. The chapter then provided an in-depth discussion of the findings of each linear regression model (revenue, employment, equity

finance, debt finance, and philanthropic models). The statistical validity of each model as well as the relationship between the dependent and independent variables were discussed. Reasoning was also provided for the findings and how it related to the theoretical frameworks discussed in the literature review chapter. The next chapter concludes and provides recommendations.

Table 4.5: Regression results

	Log(TREV)		Log(EMPLY)		Log(EQTFIN)		Log(DEBT)		Log(PHIL)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Constant	6.046	9.435	-1.091	1.216	3.492	3.514	-2.299	4.628	-0.634	7.733
Incubator	-0.936	1.045	0.046	0.161	0.613	0.557	-0.584	0.612	1.990**	0.942
Venture Age	2.900*	1.584	0.903***	0.213	-0.211	0.675	0.135	0.810	1.843*	1.087
IP Status	-1.036	1.158	-0.096	0.171	-0.073	0.658	0.644	0.650	-1.279	0.997
Founders Investment	0.327***	0.119	0.066***	0.019	0.093	0.070	0.093	0.071	0.137	0.099
Education (Secondary)										
Masters	0.285	1.386	-0.008	0.213	0.294	0.641	0.535	0.811	0.135	1.185
PhD	6.218***	2.322	1.260**	0.603	4.456	5.814	4.496	2.296	4.802	5.405
Founders Experience (Support staff)										
Senior Manager	2.153	1.475	0.163	0.233	0.198	0.800	-0.579	0.886	1.526	1.427
CEO	2.953**	1.224	0.377**	0.189	0.530	0.803	-0.136	0.719	0.345	1.076
Founders Age	-1.971	2.618	0.011	0.361	-1.060	1.042	0.508	1.375	-0.443	2.291
Gender (Male)	1.245	1.093	0.458**	0.176	0.167	0.621	0.718	0.672	0.803	0.942
F(10, 144)	2.99***		5.37***		0.92		1.09		2.00**	
R-squared	0.172		0.2718		0.0598		0.0702		0.1045	
Adj. R-squared	0.1145		0.2212		-0.0055		0.0056		0.0423	
Hetest χ^2	0.02		2.66		62.35		46.45		15.11	
Prob > χ^2	0.8899		0.1031		0.000		0.000		0.000	
Root MSE	5.9478		1.0311		3.5912		3.6631		5.4789	
Observations	155		155		155		155		155	

Note: ***, ** and * denotes significance at 1%, 5% and 10% respectively ; Hetest=Breusch-Pagan/Cook-Weisberg test for heteroskedasticity

Chapter 5: Conclusion

5.1 Introduction

This final chapter presents a summary of the study and the conclusions derived from the findings. Policy recommendations are made and limitations of the research as well as new research areas are discussed.

5.2 Summary and conclusion of study

The objective of the study was to test if SMMEs that participated in incubators had higher levels of revenue, more employees, and received more external financing (equity, debt and philanthropic) compared to SMMEs that did not participate in incubators. To perform the study, a test of selection bias was first performed to determine if incubators were not biased in their selection of participating firms based on the level of their revenues, number of employees and amount of external funding raised. There was no evidence of selection bias and the study then went further to establish the relationship between incubator participation and firm performance using Ordinary Least Squares on the sample of 182 South African SMMEs. The findings from the study indicated that incubators had a mixed impact on revenue, employment and external funding. The findings from each research objective is discussed below.

5.2.1 The effect of incubator participation on SMME revenue

The first research objective of the study was to identify if incubated SMMEs had more or less revenue compared to firms that did not participate in incubators. The empirical findings of this study indicated that incubated firms had lower levels of revenue compared to firms that had not been incubated. These findings were, however, not found to be statistically significant. There is no conclusive evidence, therefore, that SMMEs that participated in business incubators had more revenue than firms that did not participate in incubators. In fact, the findings indicated that there was a possibility that incubated SMMEs had lower levels of revenue than non-incubated firms. The variables that had a statistically significant impact on revenue were venture age, founder investment, PhD education and previous CEO experience all of which had a positive impact on revenue. This meant that the theory of human capital, which argues that performance improves with education and training, as discussed by Peña (2004) and confirmed in Fatoki (2011) had a stronger, positive impact on revenue than incubator participation.

5.2.2 The effect of incubator participation on the number of SMME employees

The second research objective of the study was to identify if incubated SMMEs had more or less employees relative to firms that did not participate in incubators. The empirical results of the study found that incubated firms had more employees than non-incubated firms. However, the relationship was not statistically significant. The author could not, therefore, reliably conclude that incubated firms generally had more employees than non-incubated firms. The author could also not confirm the theory of social capital – that a stronger social network, as a result of being incubated – increased demand for employees, as argued by Li et al. (2020). The resource based theory could also not be confirmed, which argued that incubated firms had access to more resources such as office space, funding, information and mentorship that allowed firms to outperform as per Dvouletý et al. (2018). The variables that had a statistically significant impact on employment were venture age, founder investment, PhD education, previous CEO experience and being a male founder, all of which had a positive impact on the number of employees. The employment model again confirmed the findings of Peña (2004) and supported the theory of human capital that performance was dependent on entrepreneur skill rather than as a result of being incubated. This also confirmed the theory of learning effects postulated by Coad et al. (2018). Founder investment and employees was also found to have a positive, statistically significant relationship confirming Stam and Garnsey (2007) that increased start-up capital enables growth. Founder gender (male) also had a statistically significant and positive relationship with employees.

5.2.3 The effect of incubator participation on external financing raised

The third research objective of the study was to identify how incubation affected external financing, specifically equity, debt and philanthropic financing.

The empirical results of the equity financing model were not statistically significant and none of the independent variables had a statistically significant linear relationship with equity finance raised. Therefore, the author could not infer if incubated firms had more equity financing than non-incubated firms even though there was a positive, statistically insignificant relationship. These results were, therefore, unable to confirm the findings of Lerner (2000), and Cumming and Fischer (2012) that recipients of awards (analogous to being accepted into an incubator), or firms that received business advisory services, were able to raise more equity financing (venture capital or angel investments). The equity financing model, however, did

indicate that there was a positive relationship between equity financing and founder investment, Masters and PhD education, senior manager and CEO experience, and being male. The positive relationships evident in the equity financing model with founder education levels and experience, confirmed the positive effect of human capital as discussed in Fatoki (2011) and Peña (2004). The positive relationship between venture age and equity financing supported the organisational learning theory of Calantone, Çavusgil and Zhao (date); and Argote (date as cited in Adamu, 2019) and Coad et al. (2018). The positive relationship between founder investment and equity financing confirmed the pecking order theory of financial capital, that internal or founder investment was preferred before external equity investment (Fatoki, 2011).

The empirical results of the debt financing model was not statistically significant and none of the independent variables had a statistically significant linear relationship with debt finance raised. Therefore, the author could not infer if incubated firms had more or less debt financing than non-incubated firms even though there was a negative, statistically insignificant relationship. The negative relationship meant that incubator participation was associated with lower debt funding. This contradicted other studies such as Lerner (2000), and Cumming and Fischer (2012) which found that firms in similar incubator models were able to raise equity financing, which could have been a signal for debt funders to provide financing. Cumming and Fischer (2012) found that incubated firms were more likely to receive public subsidies, indicating that incubated firms had greater access to financial resources. The debt financing model indicated a positive relationship between debt financing and venture age, IP status, founder investment, Masters and PhD education, founder age, and being male. The positive relationships evident in the debt financing model with founder education levels, further strengthened the positive effect of human capital as discussed in Fatoki (2011) and Peña (2004). The positive relationship between venture age and debt financing supported the organisational learning theory of Calantone, Çavusgil, & Zhao; and Argote (as cited in Adamu, 2019) and Coad et al. (2018) and the findings of Abor and Biekpe (2006) who found that older firms access debt more easily. The positive relationship between founder investment and debt financing confirmed the pecking order theory of financial capital, that internal or founder investment is preferred before external debt investment (Fatoki, 2011).

The empirical results of the philanthropic finance model were statistically significant indicating that at least one of the independent variables had a linear relationship with the dependent variables. The empirical results of the philanthropic model found that incubated firms raised

more philanthropic financing than non-incubated firms. The author could, therefore, conclude that incubated firms generally raised more philanthropic financing than non-incubated firms. This confirmed the discussion in InfoDev (2010), where US based incubators received government funding to provide research grants to incubated companies. This also confirmed Colombo and Delmastro (2002), who found that incubated firms were able to access public funding easier than non-incubated firms. The philanthropic financing model indicated a positive relationship between philanthropic financing and venture age, founder investment, Masters and PhD education, senior manager and CEO experience, and being male. The positive relationship between philanthropic financing and founder education as well as founder experience levels once more confirmed the positive effect of human capital as discussed in Fatoki (2011) and Peña (2004). The positive relationship between venture age and philanthropic financing supported the organisational learning theory of Calantone, Çavusgil, & Zhao; and Argote (as cited in Adamu, 2019) and Coad et al. (2018). This finding contradicted Thornton and Belski (2010), who found that the age of a non-profit firm did not impact the amount of donations it received.

5.3 Recommendations, avenues for further research and limitations

The findings of the study provided mixed results in terms of relationships that incubators had with the different performance measures. Incubator participation was found to have a negative (statistically insignificant) relationship with revenue and debt financing, a positive (statistically insignificant) relationship with employees and equity financing, and a positive (statistically significant) relationship with philanthropic financing. Therefore, it is not clear from this study that business incubators add value to SMMEs by the services they offer. The findings of the study show a clear indication that higher levels of education and experience are positively related to SMME performance. In addition, venture age and founder investment also indicated a positive relationship with SMME performance.

The recommendations from this study would be to implement policies that improves the level of SMME founder education levels, to encourage founders to invest more capital in their SMMEs, and to encourage experienced CEOs to start their own businesses.

To improve the study, it is suggested that the time horizon is extended to 36 months or longer, as Lukeš et al. (2019) confirmed that a longer study period showed more robust results. Another suggestion would be to increase the sample size to ensure that the findings are more statistically

robust. Finally, if sufficient performance information is available on individual incubators it would be worthwhile to compare performance per incubator to identify and differentiate between better and poorer performing incubators.

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