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Effect of University Technology Business Incubator services on the performance of digital enterprises in Kenya

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the research proposal contains no material previously published or written by another person except where due reference is made in the research proposal itself.

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Approval

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ABSTRACT

Much has been written about Kenya's silicon savannah – a promising digital entrepreneurship ecosystem powered by high mobile penetration, high mobile money services and high mobile Internet penetration that has catapulted Kenya to the fore front of Africa's digital renaissance. However, on one hand, Kenya is yet to fully reap the rewards of this ecosystem in the form of the creation and proliferation of high growth digital firms. On the other hand, the number of universities offering technology business incubation, aimed at converting innovation into vibrant successful businesses has increased in the recent past. The aim of this study was to assess the extent to which the services offered by these incubators in the form of technological support services, business support services and access to networks, influence the performance of their tenant firms which are digital start-ups. Drawing from resource-based view theory and social capital theory, the study surveyed 58 incubation graduates drawn from five universities incubators in Kenya. The data collected was analysed and inferential statistics was used to test the presence of significant relationships between the variables in this study. The findings of the study showed that there was a significant positive effect between business support services and access networks on the one hand and on the other, the performance of digital enterprise in terms of growth of sales, employment growth and product innovation. In addition, the study found no significant relationship between technology support services and the performance of digital start-ups. This performance was characterised as a median growth of sales of 15%; creation of a total of 199 permanent jobs, 578 temporary jobs and registration of 13 patents,13 trademarks and 113 trade secrets. The findings of this study are important to policy makers such as the Government of Kenya, managers of UTBIs, ICT industry players, such as ICT corporations and entrepreneurs of digital start-ups as it showed the utility of UTBIs as an economic development tool in advancing Kenya's silicon savannah.

Keywords: University Technology Business Incubation; Performance of digital enterprises, Digital entrepreneurship; Technological support services; Business support services; Access to networks; ICT.

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DEDICATION

This dissertation is dedicated to my loving wife Ursula and our precious children; for the formidable support and countless sacrifices made to make this thesis a reality.

ABBREVIATIONS AND ACRONYMS

BI	Business Incubator
CAK	Communication Authority of Kenya
CUE	Commission for University Education
EC	European Commission
GII	Global Innovation Index
GOK	Government of Kenya
ICT	Information Communication and Technology
ITES	IT Enabled Services
ICTA	Information and Communication Technology Authority
InBIA	International Business Innovation Association
NRI	Networked Readiness Index
NSTEDB	National Science and Technology Entrepreneurship Development Board
NTBF	New Technology-based Firm
OECD	Organisation for Economic Co-operation and Development
RBV	Resource-Based View
TBI	Technology Business Incubator
UBI	University Business Incubator
UTBI	University Technology Business Incubator
WEFD	Women Enterprise Fund
YEDF	Youth Enterprise Development Fund

OPERATIONAL DEFINITION OF KEY TERMS

Access to Networks

The provision of contact to social networks of business professionals, financiers, entrepreneurs and university faculty and research networks to nascent firms aimed at helping start-ups form mutual beneficial connections that better their firms and ameliorate their entrepreneurship skills.

Business Incubation

Business intervention programs that provide physical facilities, technical and business skills transfer, managerial mentoring as well as financial support to nascent entrepreneurs during their initial early stages when they are susceptible to failure to substantially increase their chances of growth and survivability.

Business Support Services

These services include business skills training in areas such as marketing, strategy, finance, entrepreneurship mentoring and funding.

Digital Enterprises

Micro, Small and Medium enterprises or start-ups, also referred to as digital start-ups, that focus on the commercialization of Information Communication and Technology (ICT)-based and mobile money-based innovations.

Digital Entrepreneurship

A term that collectively refers to digital start-ups and the entrepreneurs who start and establish these firms

Innovation hub

A centre that provides a physical location and virtual space to a collaborative community of founders, technology enthusiasts, and other members with highly diverse knowledge to promote a local technology-based entrepreneurial culture

Technological Support Services

These are the physical infrastructure facilities provided to tenant firms in University Technology Business Incubators such as parking space, work spaces, Internet access, access to university laboratories and includes technical training.

Technology

Refers in this study to computer, Information Technology, and mobile based systems

Technology Business Incubator

A special type of business incubator that concentrates on knowledge intensive or high technology enterprises often with substantial involvement of academia, but not necessarily domiciled in an academic institution such as a university. It can also be thought of as a type of business incubator that couples, technology, know-how with entrepreneurial talent and risk capital and is an umbrella term for all forms of technology business incubation regardless of location.

Technology Hub

Also referred to as a tech hub, collectively refers to innovation hubs and technology business incubators.

University Technology Business Incubator

This is a type of Technology Business Incubator that is based in a university, an innovation-based enterprise development mechanism used by enterprising universities in synergistic collaboration with other stakeholders to support and nurture technology-intensive firms.

University Technology Business Incubator Services

The repertoire of services offered by Technology Business Incubators based in universities aimed at improving the performance of their tenant firms on several performance dimensions and for this reason, these services are also referred to as value-added services.

CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter underlined the rationale for this study. It starts by explaining the potential of small and medium digital enterprises and the challenges they face and how strategies such as technology business incubation help to improve the performance of digital start-ups. It also explains in brief why university technology business incubators (UTBI) are particularly suited for nurturing technology-intensive firms by highlighting some of the key services provided by UTBIs as well as the key performance indicators for digital enterprises. The chapter also depicts the state of the Kenyan technology landscape and locates the study in the government of Kenya national ICT masterplan. The chapter lays out the problem statement, the research objectives and questions and concludes by outlining the scope, limitations and significance of the study.

1.2 Background Information

1.2.1 The Potential and Challenges of Digital Enterprises

Governments, policy makers and industry experts worldwide recognise the important role that digital micro, small and medium enterprises play in economic development. Akçomak, (2011) posits that due to their small size they are more responsive to changes in the economic and technological environment and hence form the foundation for policy making for the creation of new enterprises and employment. In most developing countries, Micro, Small and Medium Enterprises (MSMEs), which include technology-intensive firms, make up most firms and play a significant role in employment creation and economic growth (Scaramuzzi, 2002). The same can be said for developed countries where small innovative firms are engines of economic growth in the US and other regions of the developed world and are considered to contribute significantly to their knowledge-led global economies (Mian, 2014). However, digital start-ups face several challenges; they cannot benefit from economies of scale on the input and output side (Akçomak, 2011); they face difficulties in gaining access to resources (both tangible and intangible), poor management skills, limited access to scientific knowledge and a lack of know-how are detrimental to the survivability of

technology-intensive enterprises (Gassmann & Becker, 2006; Nowak & Grantham, 2000; Peters, Rice, & Sundararajan, 2004). While these factors hamper digital start-ups worldwide, in developing countries such as Kenya these drawbacks are further exacerbated due to a volatile macroeconomic environment, inadequate and/or underdeveloped formal institutions and lack of human capacity (Akçomak, 2011). In addition, technology-intensive enterprise such as digital firms face additional unique challenges. Firstly, according to Stigliz & Weiss as cited by Chen (2009), financiers find digital firms more difficult to understand and hence subject them to more credit rationing than their non-technology-based counterparts. Secondly, digital firms operate in a rapidly changing environment and face the twin challenge of mastering this fluid environment as well as developing the technical capacity to churn out products fast enough and of sufficient scale to address a broad market (Chen, 2009). Thirdly, in developing economies such as Kenya, the lack of a national system of innovation that can holistically provide risk capital, well developed business and technical services limits the growth of digital start-ups (Akçomak & Taymaz, 2007; Colombo & Delmastro, 2002).

1.2.2 Technology Business Incubation – The Potential for Entrepreneurial Renewal

In the light of these challenges technology business incubation becomes attractive to policymakers and practitioners as a tool to alleviate the challenges faced by technology-focused MSMEs. Incubators promote technological and industrial development by providing a repertoire of business services and support (Hackett & Dilts, 2004). Specifically, they can be viewed as a tool that firstly promotes regional growth and development through employment creation, secondly, for creation of new enterprises, technology-intensive entrepreneurship, commercialization and transfer of applied research and thirdly, to deal with market inefficiencies related to know-how and other inputs of innovative process (Colombo & Delmastro, 2002; McAdam & McAdam, 2008; Mian, Corona, & Doutriaux, 2010). The statistics on survivability of new ventures globally are grim; over 30 per cent do not survive beyond the third year and 60 per cent do not live beyond the seventh year (OECD, 2002). Incubation increases the odds of survivability with this number thought to fall by 15-20 per cent among firms in incubators (Adegbite, 2001; Lalkaka, 2002). This explains why the

last three decades there has been a high growth in the number of business incubators; according to InBIA (2015), there are 7000 incubators globally, with 30 per cent being technology business incubators. Akçomak (2011) opines that only 40 per cent of these are in developing countries with the majority in Brazil, India and China.

1.2.3 Why University Technology Business Incubators?

In Kenya, there were an estimated 11 tech hubs in 2015, although this includes facilities that do not necessarily offer incubation, only two Technology Business Incubators (TBIs) were based in universities (Kelly & Firestone, 2016). Universities play a critical role in the growth of new technology-based firms (NTBFs) in five main ways. Firstly, universities provide training for students to prepare them for technology-based entrepreneurship, many digital entrepreneurs are university educated; secondly, they promote research that creates opportunities for innovation; thirdly, they provide academic staff who can provide consulting services to nascent firms; fourthly, they foster the creation of firms that can leverage academic R&D activities and fifthly provide staff and students as possible employees for new technology-intensive firms (Mason & Brown, 2014; Mian, 2014). Amezcua, (2010) argues that incubators associated with universities produce more successful firms than those that do not. Some scholars such as Lalkaka (2002) attribute the success of Silicon valley partly due to its association to universities such as Stanford university that provide a steady stream of innovations and subject-matter-experts in the form of university professors. Moreover, world over, universities are moving beyond their traditional pedagogical role and are participating directly in economic development by providing programs such as technology business incubation services in partnership with industry players (Guerrero, Urbano, Fayolle, Klofsten, & Mian, 2016; Healy, Perkmann, Goddard, & Kempton, 2014). In return the universities benefit by providing employment opportunities for their students, commercializing academic research, increased enrolment in business and technical courses from staff of their tenant firms and improved prestige or public image especially when the university is able to set a track record for innovativeness (Mian, 2014). Predictably, the number of university business incubators in Kenya has risen to eight from just two in 2015.

1.2.4 University Technology Business Incubator Services

UTBIs add value to their tenant firms through the services they provide. The nature of services provided have evolved over time from mere physical facilities such as work spaces and advanced scientific laboratories to include training in business skills, entrepreneurship mentoring, technical training, technology transfer programs, financial support as well as access to networks of financiers, business professionals, research community and fellow technology entrepreneurs (Hackett & Dilts, 2004; Mian, 2011; Mian, Lamine, & Fayolle, 2016). The study adopted the grouping of these services from Bruneel, Ratinho, Clarysse, & Groen, (2012) and Somsuk, Punnakitikashem, & Laosirihongthong (2010) categorizing the services provided into – technological support services, business support services and access to networks.

1.2.5 Performance Dimensions of Digital Enterprises

The growth or performance of start-ups, digital start-ups included, can be defined in terms of profits, sales, cash flow, assets, number of employees, number of patents and copyrights, amount of fund raised, graduation/survivability rate of tenant firms (Akçomak & Taymaz, 2007; Chen, 2009; Pompa, 2013). There is no universal agreement on which success factors should be measured and this complicates the assessment of UTBIs and their tenant firms (Mian et al., 2016). However, this study will focus on growth of sales, growth of employment and product innovation as performance measures. The choice of these factors is guided by firstly, past studies such as Akçomak & Taymaz (2007), Ensley & Hmieleski (2005), Löfsten & Lindelöf (2002) and Wachira, Ngugi, & Otieno (2016) are consistent in the use of growth of sales, growth of employment and product innovation as performance indicators for start-ups. Secondly, growth of sales, growth of employment and product innovation are among the most important factors considered by independent investors when investing in technology-intensive start-ups (Drouillard, Taverner, Willamson, & Haris, 2014).

1.2.6 Kenya's Digital Transformation

Nairobi the capital city of Kenya has been at the heart of a digital transformation over the past 16 years, marked by three distinct developments. Firstly, since the liberalization of the Telecommunication sector in 2002 mobile penetration has risen to 90.4% (CAK, 2017). Secondly, since 2009 when the first submarine fibre landed in

Mombasa, a coastal town in Kenya, the Internet capacity available in Kenya has risen to 2.9 Terabytes of available international capacity with undersea cables accounting for 99.9% of all International Internet bandwidth in the country; this has in turn led to a high Internet penetration with 31 million Internet subscriptions of which 99% are mobile data subscriptions (CAK, 2017). The growth of mobile money services since its launch in 2007 has seen the number of mobile money users grow to 28 million with the value of quarterly transactions rising to Kenya Shillings 1.7 trillion by September 2017 (CAK, 2017). While these figures do not represent unique subscribers, they point to a significantly high mobile Internet and mobile money penetration.

According to Drouillard et al (2014, p. 20), the high mobile phone penetration, high mobile Internet penetration and high mobile money adoption have led to a "digital entrepreneurship ecosystem, with the mobile platform becoming the platform of choice for the launching of digital services in Kenya". This ecosystem consists of entrepreneurs, mobile network operators, private equity, commercial lenders, venture capitalists, government, ICT corporates, development organisations and innovation hubs (Drouillard et al., 2014).

1.2.7 ICT - a key government priority

Although ICT has featured prominently over the last decade in Kenya's strategic plan (Vision 2030) as a key foundational medium-term plan under the Economic pillar, it was not until the launch of the National ICT Masterplan in 2014, that the government defined its most detailed strategic plan on ICT and ICT development in Kenya (GOK, 2008; ICTA, 2014). According to ICTA (2014), the government outlined very clear objectives, strategies and goals towards becoming an innovation-led economy. The plan identified three pillars, firstly, E-government to drive the use of ICT in government for efficient service delivery to its citizenry; secondly, ICT as an industry driver to enhance competitiveness, productivity and growth for key economic sectors identified in vision 2030 and thirdly, the development of ICT business that produce world-class quality IT products and services for export (ICTA, 2014). To achieve the third pillar, the plan detailed several strategies such as the commercialization of ICT-related innovations through the promotion of incubators to support new start-ups, setup of Centres of Excellence and Science and Technology Parks (of which Konza Techno city is one of the flagship projects aimed at creating a Science and Technology

park and ITES Centre) for developing applications and services, as well as the development of a national framework for business incubators (ICTA, 2014). This study focuses on this third pillar, the development of ICT businesses and more specifically the sub-pillar of commercializing technology innovations using University Technology Business Incubators (UTBIs) as an economic development tool.

1.3 Problem Definition

According to Drouillard et al (2014), Kenya has the potential to be a leading hub of digital entrepreneurship. The sector while rich in innovation ideas has struggled to commercialize these ideas with digital start-ups facing a significant mismatch between a high level of innovation and low "deal-flow" (Drouillard et al., 2014; Kelly & Firestone, 2016). Secondly, the growth challenges of digital start-ups is compounded by a high start-up mortality rate in Kenya; KNBS as cited in Mwobobia (2012), state that three out of four start-ups fail within the first few months of operation; 75% of new ventures in Kenya fail within three years of their birth (Kaburi, Mobegi, Kombo, Omari, & Sewe, 2012). Thirdly, there is evidence of successful use of university technology business incubators as an economic development tool; these include Silicon Valley (that began with the establishment of Stanford Industrial Park), Boston Route 128 (US) and Cambridge's Silicon Fen (UK) (Library House, 2006; Mian, 2011; Roberts & Eesley, 2009). Battelle (2007), report that the134 research university science parks in North America studied (that included UTBIs) had created 750,000 jobs in a period of over two decades by 2007; Mian as citied in Akçomak, (2011) explains that US UTBIs studied in 1996 and 1997 reported a 10-fold growth in sales and 400% increase in employment rate of tenant firms over four years. Similar results are reported in Sweden where firms in science parks affiliated with universities consistently outperform non-incubated firms in terms of sales and employment growth by a factor of over 60% and 170% respectively (Lindelöf & Löfsten, 2002, 2004, Löfsten & Lindelöf, 2001, 2002). In developing markets such as Brazil, they are thought to have created 15,000 jobs in 2009 and lowered start-up mortality rate from 50 percent to seven percent (Oliviera & Menck, 2008); in India according to NSTEDB (2014), technology incubation was responsible for generating turnover of United Stated Dollars 231 million and 32,000 jobs in 2012-2013; in China, incubation as a

whole is thought to have reduced start-up mortality rate from 70% to 20% and created 600,000 jobs by 2009 (Akçomak, 2011; Chandra & Chao, 2011).

Fourthly, UTBIs are not a panacea and sometimes do not succeed due to poor sustainability models, poor management, mismatches between innovation, entrepreneurial talent and local industry requirements (Adegbite, 2001; Mian, 2011, 2014); there are cases where they do not offer long term benefits beyond incubation and cases where their tenant firms do not outperform non-incubated start-ups in terms of cash flow, profits and level of innovation (Ensley & Hmieleski, 2005; Schwartz, 2011). Fifthly, majority of the studies on UTBIs have been conducted in predominantly high-income and upper middle-income countries with different social, political and economic environments compared to Kenya and may not necessarily apply. In summary, since digital start-ups are struggling to achieve commercial viability, to what extent do UTBI services foster the translation of innovative ideas into successful businesses?

1.4 Research Objectives

1.4.1 General Objective

The main objective of the study was to assess the effect of University Technology Business Incubator services on the performance of digital enterprises in Kenya

1.4.2 Specific Objectives

i. To analyse how the technological support services provided by UTBIs foster the performance of their tenant firms
ii. To determine how the business support services provided by UTBIs influence the performance of their tenant firms
iii. To assess how access to networks, as a service provided by UTBIs affect the performance of their tenant firms

1.4.3 Research Questions

The following are the initial research questions used in the study which were converted to research hypotheses in chapter two after providing justification for the hypotheses from literature.

i. What is the relationship between the technological support services provided by UTBIs and the performance of their tenant firms?
ii. Do the business support services provided by UTBIs affect the performance of their tenant firms?
iii. Is there any relationship between access to networks, as a service provided by UTBIs and the performance of their tenant firms?

1.5 Scope of Study

The study was limited to digital entrepreneurs who had graduated from UTBIs in Kenya. The study was cross sectional study and was limited to UTBIs and their tenant firms in Kenya. Although there are numerous services provided by UTBIs the study was limited to business support, technological support and access to network services as defined in this study. The rational for this selection was that past studies have shown that these services correlate positively with the performance of nascent firms, albeit in different circumstances and angles than those that are the subject of this study (Akçomak & Taymaz, 2007; Hackett & Dilts, 2004; Wachira et al., 2016). Furthermore, this study built on Wachira et al. (2017b) the basis for the published studies Wachira et al. (2016) and Wachira, Ngugi, & Otieno (2017a), but with a focus on technology-intensive start-ups and their performance.

1.6 Significance of the Study

For universities and the management of UTBIs, the study highlighted the significant relationships between the services provided and performance of their tenant firms, firstly to demonstrate the utility of the services in enterprise development and secondly it identified areas of improvement in the services provided.

For policymakers such as the Government of Kenya, the study showed how UTBIs perform as an economic development tool that contributes positively to GDP by promoting revenue growth, job creation, and innovation. It also showed the extent to which UTBIs and their tenant firms leverage government risk capital funds namely the Youth Enterprise Development Fund and Women Enterprise Fund. It also identified gaps that policymakers should address to strengthen the impact of UTBI services.

For industry players such as ICT corporations, venture capitalists and business professionals the study showed how access to their networks affect the performance of nascent digital firms. It also showed the current strength of ties between business professionals, university, financiers and digital start-ups and identified gaps that both industry players and UTBIs should work collaboratively to address.

For digital entrepreneurs the study characterised the UTBIs services provided and demonstrated the extent to which they improved the performance of their businesses and gave a detailed description of this performance in terms of average annual percentage sales growth, types and number of jobs created and product innovation in terms of number of intellectually property rights registered and the product release cycle.

Lastly, the study contributed to the general body of literature on university technology business incubation in Kenya.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter begins with a brief historical review of technology business incubators, in the US, Brazil, China, India and Kenya. It then reviews the theoretical framework underpinning the study and reviews empirical literature on UTBI services and performance measures of UTBIs narrowing down to those applicable to this study. In discussing the independent variables of this study, justification is given for the formulation of research hypotheses, which are developed in this chapter. In addition, it reviews the role played by Government and culture, presents past evidence of the impact of UTBIs services globally and reviews past studies of incubation in Kenya and their relevance to this study. Lastly, the section concludes with a critique of the reviewed literature and articulates the research gaps that justified this study.

2.2 Brief Overview and History of University Technology Business Incubators

2.2.1 The Entrepreneurial University and birth of UTBIs

The origin of the University business incubation model is thought to have begun in the early 19th century when Humboldt popularised the German University model that emphasised the importance of research as an integral part of teaching and hence gave birth to the modern research university (Albritton, 2006). This model went through transformation in the mid-19th century in the US, when some universities (that were US Land Grant Colleges) added innovative initiatives as part of their outreach function, to commercialise technology in the agricultural sector and laid the cornerstone of a successful support strategy for businesses (Mian, 2011). This model was expanded for wider adoption beyond agriculture by the establishment in 1924 of the Wisconsin Alumni Research Foundation (WARF), a separate firm that was affiliated to the University of Wisconsin, a Land Grant Institution, with the WARF model being instrumental to the setting up of the university technology transfer function (Feldman, 2003; Mian, 2011). The establishment of the Stanford Park (then known as the Stanford Industrial park), by Stanford University's Provost and Dean of Engineering Fredrick Terman, in 1951 is the thought to have given birth to the TBI

movement (Mian et al., 2016). Over the years, a combination of changes to legislation, reduction of funding of public universities (that pushed universities to look for new sources of funds), new innovative-intensive industries, proliferation of know-how on commercialization success and changes in R&D investments led to acceleration of the technology transfer practice, which led to further changes in US legislation in the 1960s and 1970s in support of the commercialization of federal-funded research – a practice that spread to Europe and laid the foundation of the modern entrepreneurial university (Etzkowitz, 2002; Mian, 2011). Today, the activities of entrepreneurial universities have expanded beyond commercialization of research to include technology business incubation in science parks and technology centres with university-specific value-added services in the form of R&D facilities, R&D staff and consultants, network of key contacts, a good public image that accrues from university affiliation and collaboration and exchange of ideas among entrepreneurs domiciled in UTBIs (Chan & Lau, 2005; Colombo & Delmastro, 2002; Lindelöf & Löfsten, 2004). Furthermore, Mian (2014), posits that these unique services make UTBIs especially suitable for the nurturing of new technology based firms (NTBF).

2.2.2 Development of UTBIs in Emerging Markets – Brazil, India and China

Technology Business Incubators (which include UTBIs) in emerging markets developed differently from those in the US and other developed countries. This section briefly reviews how UTBIs evolved in Brazil, India and China since these countries host a majority of incubators outside of developed economies (Akçomak, 2011; Chandra, 2007; Chandra & Chao, 2011) .In Brazil, incubators started in the mid-1980s with the first incubator starting in 1986; the program did not pick up pace until ten years later when universities who had promoted the idea of business incubation, led to its adoption as an entrepreneurship development policy (Akçomak, 2011). In many ways Brazil's development is thought to be a bottom-up approach with universities playing a key role in bringing in the requisite policymakers/government, financiers and industry players together to make business incubation a success (Chandra, 2007). Of note is that initially, the UTBIs, like their US counterparts were setup to cater for academic spin-off keen to commercialize research, but the incubators encountered challenges such as lack of risk-capital funding, poor business services, and poor associations with academic staff (Akçomak, 2011). However, the lack of funding and

lack of a national strategy on incubation gave birth to less costly, flexible and sustainable models aimed at meeting local needs (Etzkowitz, de Mello, & Almeida, 2005). The need for support for policy and financial support was met in the mid-1990s when the Institute of Technological Training Support Programme (PACTI) working with the National Advanced Technology Enterprise Promoter Entity (ANPROTEC) put in place a national strategy to support business incubation (Akçomak, 2011). By 2009, there were over 400 incubators in Brazil, over half of which were UTBIs and were estimated to have created 15,000 jobs and lowered the start-up mortality rate from 50 per cent for non-incubated firms to seven per cent for incubated firms (Oliviera & Menck, 2008). Incubators are generally linked to universities and funded by various governmental and non-governmental sources (Chandra, 2007); they also reflect the synergy from the so-called triple helix of university, industry and government (Etzkowitz et al., 2005).

In India, the National Science and Technology Entrepreneurship Board (NSTEDB) was setup up in 1982 with a broad based mandate to promote self-employment in the science and technology sector and to setup knowledge-based businesses (NSTEDB, 2014). According to NSTEDB (2014), this in turn lead to creation of the Science and Technology Entrepreneurship Program (STEP) under NSTEDB in 1984, in collaboration with the then-government owned financial institutions such as Industrial Development Bank of India (IDBI), Industrial Finance Corporation of India (IFCI) and Industrial Credit and Investment Corporation of India (ICICI); STEP targeted the commercialization of university research (similar to the objectives of the Kenya National ICT Masterplan) in response to the large number of unemployed science and technology graduates. However, NSTEDB did not focus only on technology but other areas of science such as biotechnology, manufacturing, micro-electronics, energy environment and energy since at the time most host institutions did not have the capacity for advanced technology (NSTEDB, 2009). One of the tools used by STEP was technology business incubators and it is estimated that between 2001-2013 they were responsible for increasing the start-up survivability rate to between 70 to 80 percent, creating 32,000 jobs, generating annual turnovers of United States Dollars 231 million by 2012-2013 and generating 450 intellectual property patents (NSTEDB, 2014). Although the extant literature on incubation in India does not distinguish

between UTBIs and other TBIs, it is estimated that between 67 to 75 percent of technology business incubators in India are located in universities (NSTEDB, 2009, 2014; Thillairajan & Jain, 2013).

In China business incubation began in the late 1980s and with the government playing a predominantly role business incubation has become very successful with over 500 incubators (by 2009) and creation of an estimated 600,000 jobs (Chandra, 2007). The government under the Ministry of Science and Technology (MoST) provides support to incubators via the Torch High Technology Development Centre (TORCH) program; what is unique about China's approach is its focus on high-technology to transition to a technology-intensive market economy (Chandra & Chao, 2011; Harwit, 2002). Lalkaka (2002) estimates that by 2002, China had spent United States Dollars 1.6 billion to construct business incubation facilities. Although, the sector lacks objective quantitative assessment it is estimated that the movement of scientific achievements to production increased from 30 per cent to 70 per cent, and survivability of high technology ventures increasing from 30 percent to 80 percent due to business incubation (Akçomak, 2011). However, by 2011, the services provided were basically tangible (infrastructure based) and business support was poor due to lack of experienced managers (incubators were managed by government officials and not business professionals) and was exacerbated by a risk-averse culture and a large number of tenants per incubator; average number was between 60-70 firms but some had up to 150 start-ups (Akçomak, 2011; Harwit, 2002). Apart from direct funding of universities to strengthen R&D, the government had also setup innovative incubation models for overseas scholars who wished to exploit their innovations in China (Ling et al., 2007).

2.2.3 Development of Incubation in Kenya

In Kenya, the first incubator is thought to have started in 1967 when the Industrial and Commercial Development Corporation (ICDC) founded the Kenya Industrial Estate (KIE) as a subsidiary whose aim was to provide physical infrastructure (work spaces) country wide as well as provide financial and business support services to local industries (Ikiara, 1988). Even though other incubators such as the International Finance Corporation SME Solution Centre, Kenya Industrial Research and Development Institute (KIRDI) and the Kenya Kountry Business Incubator (Kekobi)

were established, it was not until 2010 when iHub was founded that Kenya began its journey on technology business incubation (Bwisu, 2005; Kelly & Firestone, 2016). Although at first iHub was technically an innovation hub, it was the catalyst for the formation of technology business incubators such as m:Lab East Africa, Nailab and UTBIs such as Strathmore University iBizAfrica and University of Nairobi C4D lab. Kenya's TBI journey was pioneered using an academia and industry partnership model. m:Lab one of the first TBIs was started in 2011 under the World Bank infoDev program as a consortium of four firms; eMobilis that handled training and certification; University of Nairobi, School of Computing and Informatics responsible for research; World Wide Web Foundation, responsible for curriculum, content, training and education and iHub for community interaction and collaboration, workspace and access to capital and markets (Kelly & Firestone, 2016; mLab, 2011). Recently, the concept of university technology business incubators has taken root with a total of eight universities offering some form of incubation in between 2011 to 2018. These are Strathmore University iBizAfrica, University of Nairobi C4Dlab, Kenyatta University Chandaria Business Incubation and Innovation Centre, Jomo Kenyatta University of Agriculture and Technology Nairobi Industrial and Technology Park (NITP), Kenya College of Accountancy (KCA) University Business Incubation Centre, Dedan Kimathi University of Technology, DeHUB, Technical University of Kenya, Business/Technology Incubation Unit and Mount Kenya University Business Incubation Centre. However, in 2017, University of Nairobi C4Dlab suspended its incubation program and KCA University Business Incubation Centre scaled down operations to only offer workspaces. The National Industrial and Technology park incubation program is still in its formative stages as the institution is expanding its facilities to accommodate more entrepreneurs.

At the same time the increase in the number of UTBIs had coincided with Kenya's rise in innovativeness. From a global benchmarking view point, Kenya leads other low middle-income countries in two key global metrics. Firstly, the Global Innovation Index (GII) an annual report, co-sponsored by the World Intellectual Property Organization (WIPO), that tracks and ranks the innovation performance of 127 economies based on an average of innovation input and innovation output factors (Cornell, INSEAD, & WIPO, 2017). Secondly, the Global Information Technology

Report, Networked Readiness Index (NRI) – an annual World Economic Forum (WEF) report which assesses and ranks the most digital savvy economies in the world based on the political, regulatory and business environment, readiness measured in terms of skills, affordability and infrastructure, usage (at an individual, business and governmental level) and social and economic impact (WEF, 2016). According to Cornell, et al (2017) Kenya has been ranked, for seven years consecutively, as an innovation achiever, at par with India and Vietnam by GII. Kenya's Global ranking improved from position 99 in 2013 to position 80 in 2016, and from seventh to third in Sub-Sahara Africa within the same period (Cornell, INSEAD, & WIPO, 2013, 2017). Moreover, according to WEF (2013, 2016), Kenya's NRI ranking improved from 93 in 2012 to 86 in 2016, and was ranked sixth in the top countries harnessing IT in Sub-Sahara Africa – though this was a slight drop in ranking from position five in 2015.

2.3 Theoretical Framework

2.3.1 Resource-based View (RBV) Theory

The premise of the RBV theory is that nascent firms need a repertoire of tangible and intangible resources and convert these resources, with the firm's inherent capabilities into products and services which earn the firm revenue (Barney, 1991). Tangible resources differ from intangible resources in that there are physical such as equipment and buildings while non-tangible resources refer to all non-physical resources. However, these resources must meet four criteria; they must be rare; valuable to the firm; not easy to substitute and inimitable by competitors (Wernerfelt, 1984). In addition, the theory differentiates between resources and capabilities; with the former being assets that the firm owns or controls and the latter being skills and know-how or in other words what the firm can do (Luo & Huang, 2008; Mahoney & Pandian, 1992). The theory states that the growth and development of a start-up firm is determined by how effectively and efficiently it uses resources and its inherent capabilities implemented through organizational processes to gain a competitive advantage (Somsuk et al., 2010). In the context of UTBIs, RBV theory can be used to explain how resources provided by the incubator contribute to the growth of start-up

firms as well as identify those factors or resources that play a role in the success of a UTBI (Lendner, 2007). At the same time, it can be used to explain differences in the performance between start-ups in different incubation programs, if the resources provided to these start-ups are different – the differences in firms is due to the differences in resource and capabilities (Barney, 1991). UTBIs not only provide resources but also enhance the capacity of nascent technology-intensive firms; Shan (1990), argues that technology-based start-ups are more vulnerable than other SMEs as they must quickly develop the organizational capacity to develop new technology products as well as master the rapidly changing environment they operate in. Hence based on RBV theory technological support services and business support services as resources when combined with a start-ups capability can positively impact their performance.

2.3.2 Social Capital Theory

The first definition of social capital was produced by Pierre Bourdieu in 1980 as the "aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu 1985, p. 248 as citied in Portes, 1998). It is the benefits or resources that accrue to individuals from associations with others and the purposeful creation of sociability to gain these benefits (Portes, 1998). Woolcock & Narayan, (2000) use the expression "it is not what you know, but who you know" to capture the essence of social capital; that one's social association in the form of friends and family is a valuable asset and can be called upon in times of crisis or for its own sake and used for benefit. However, this association and accruing of value is not only to an individual attribute but can also been seen as a community feature where value is created by networking, trust and norms of reciprocity (Putnam, 2001). Not all the value created by networks is good, there are positive and negative consequences of social capital; for example actors with superior information due to their networks can keep weaker actors (who don't share the same networks and hence don't have the same information) at a disadvantage and limit their freedom (Portes, 1998). Fukuyama (1995) posits that there is a relationship between social capital, trust and economic well-being; he theorized that economic performance of different nations was correlated with the levels of trust in the society, with societies having higher levels of

trust enjoying higher levels of wealth, equality and economic competitiveness. He argues that economic and business success does not accrue only from the lavishness of raw materials, good legislation, solid institutions and intelligence but also on a culture of trust that fosters relationships beyond family circles. He points out that the inability of family enterprises to grow is due to their inability to build relationships outside family circles and that trust and shared values are critical in forming valuable relationships. In the context of business incubation, early generations of BIs only considered internal interactions with tenant firms co-located in the same facility as important in fostering the sharing of ideas and collaboration (Hackett & Dilts, 2004). However, networking has taken more importance recently since the success of the entrepreneur is thought to depend not only on his/her activities but also on co-operation with others (Grimaldi & Grandi, 2005). This co-operation occurs within networks that compensate for a nascent firm's liability of newness that normally manifests in three ways; first, is the challenge of being on your own as opposed to being part of a "community", second, is administrative support and third is the firm's newness and its lack of visibility in the market (Mcadam & Marlow, 2007). Hence access to networks, as a service provided by UTBIs can provide benefits to nascent firms by allowing the firms to work collaboratively with others and contribute positively to their performance.

2.4 Empirical Literature Review

The strengths of UTBI services emanate from universities breadth and depth in research and the development of new knowledge. Mian (2014), posits that universities offer distinct value-added services that are beneficial for the development of technology-based firms. Among them are access to R&D facilities, student employees, university image and faculty consultants. Lindelöf & Löfsten, (2004) posit that universities offer networking benefits to tenants and offer opportunities for collaborative R&D as well as access to the university research network. However, Chan & Lau (2005) in their study of TBIs in the Hong Kong Science Park posit that the value tenants attach to these value-added services is dependent on the incubator's stage of development. In addition, Guerrero et al. (2016) posit that there is more to the entrepreneurial university than has been framed in technology and research terms by extant literature.

2.4.1 UTBI Services – Technological support services

2.4.1.1 Infrastructure

Infrastructure refers to the physical facilities provided by the incubator in terms of work space and office equipment This is the most common service available in business incubators and characterised the first generation of business incubation (Lalkaka, 2002). It also includes shared services such as meeting rooms, conference rooms, clerical services and reception (EC, 2002; McAdam & McAdam, 2008). Chan & Lau (2005) posit that rent breaks is the most valuable service to tenant firms. Infrastructure also refers to specialised scientific equipment, laboratories, and other R&D facilities that are expensive in nature and hence is only found in research centres typically in universities. It is viewed as one of the advantages of UTBIs that tenant firms can leverage (Amezcua, 2010; Colombo & Delmastro, 2002). Bruneel et al (2012) posit that infrastructure benefit tenant firms in three ways; firstly, they can take advantage of economies of scale, arising from shared resources made available to tenants; secondly, it frees tenants from the encumbrances of looking for their own individual work spaces and enables them to concentrate on innovations; thirdly, the facilities provided may not be affordable to early-stage start-ups.

2.4.1.2 Technical Training

This refers to the transfer of technical skills to tenant firms. According to Smilor & Gill as cited in Bruneel et al. (2012), this includes transfer of know-how which is the composite collection of all research, methods, processes, procedures, protocols and the like that arise from university research and technology or ideas which is the application of science concepts to industrial or commercial use. It also includes formal technical training programs or seminars offered by the incubator (Peters et al., 2004). Drouillard et al (2014) argue that the digital entrepreneur in Kenya is mostly self-taught and does not have access to training on mobile technology that is crucial to improve the quality of their products.

2.4.1.3 Research Hypothesis H_{01}

Mian (2014) and Mian, Fayolle, & Lamine (2012) posit that physical facilities and technical training make UTBIs particularly suitable for nurturing technology intensive firms since they found such services valuable to tenant firms and linked these services

to the performance of the tenant firms. This is consistent with other studies such as Amezcua (2010) and Colombo & Delmastro (2002). Hence the following null hypothesis based on research question one and the findings in literature, was formulated;

H_{01} *There is no relationship between the technological support services provided by UTBIs and the performance of their tenant firms*

2.4.2 UTBI Services – Business support services

These are intangible services offered by UTBIs and are sometimes referred to as the "software" of technology business incubation that is necessary to fully leverage the "hardware" of space and physical facilities (Lalkaka, 2002).

2.4.2.1 Business Training

Most entrepreneurs of technology-based enterprises are often experts in their respective technology field but often lack business and management skills which limits their chances of survival (Chan & Lau, 2005). This is also the case in Kenya, where the digital entrepreneurs are majorly from an IT or engineering background (Drouillard et al., 2014). Business skills in marketing, accounting, people management and business development are crucial in empowering these nascent entrepreneurs with the skills necessary to turn their ideas into viable businesses (Bruneel et al, 2012). Also of importance is knowledge on intellectual property protection since in 2014, only 15% of digital start-ups had protected their ideas through intellectual property rights (Drouillard et al., 2014).

2.4.2.2 Entrepreneurship mentoring

This refers to one-on-one mentoring of founders of technology-intensive firms who lack the experience to navigate a constantly changing business environment. They are simply too new in the game to know what to do and are unable to hire the relevant help (due to cost or market constraints) or are unable to find consultants with experience working with start-ups; it then becomes crucial that seasoned incubation management play this role (Bruneel et al., 2012). Clarysse & Bruneel (2007) posit that the coaching or mentoring is geared towards accelerating the tenant's learning process

and covers both managerial and technical areas. Mian, (2011) warns that regular monitoring is not a given, incubator management often spend time looking for funding and leave their tenant firms in dire need of entrepreneurial advice. According to Drouillard et al. (2014), the Kenyan digital entrepreneur is help back by a lack of proper entrepreneurship mentoring, which would help them better qualify the opportunities for their business, deepen their understanding of how to scale and grow their business, refine and refocus their business strategies as well as point our weakness or knowledge gaps to be addressed. Moreover, experienced mentoring would help nascent enterprises convert their ideas to profitable business models (Drouillard et al., 2014).

2.4.2.3 Funding

This refers to provision of financial resources to the tenant firms in the form of loans or grants either directly or indirectly by the UTBI. In China under the TORCH program, the government directly funds promising tenant firms (Chandra, 2007; Chandra & Chao, 2011). In other cases, the tenant firms are funded under specialized funds created specifically for the UTBI or by the government or provided jointly by the UTBI and government (Chan & Lau, 2005; Scaramuzzi, 2002). In Kenya, key to enterprise development is the provision of risk capital through government entities such as the Youth Enterprise Development Fund (YEDF) and Women Enterprise Fund (WEFD) which are both social pillars of Vision 2030 (GOK, 2007). These funds have been actualized by the formation of a State Corporation - Youth Enterprise Development Fund and a semi-autonomous state agency the Women Enterprise Fund in May and August 2007 respectively (WEFD, 2015; YEDF, 2016). Drouillard et al, (2014) explain that in 2014, the digital entrepreneur faced significant capital constraints especially for early-stage companies with 60% of the start-ups bootstrapping just to survive with no external funding – these government risk capital funds may ease these capital constraints for qualified youth and/or women. Aerts, Matthyssens, & Vandenbempt, (2007) posit that incubators rarely fund their tenant firms directly and instead facilitate contact with potential financiers of start-ups such as business angel networks and venture capitalists. This is critical for digital enterprises since in 2014, only 2% of start-ups were funded by business angels compared to 32% in Silicon Valley (Drouillard et al., 2014). Also important is an

understanding of the what investors look for in start-ups as some investors express frustration with the quality of teams soliciting for growth capital – the start-up teams lack the right balance in skills and relevant experience to be invested in (Drouillard et al., 2014).

2.4.2.4 Research Hypothesis H_{02}

According to Drouillard et al. (2014) some of the factors that hamper the performance of digital firms include a lack of business training, insufficient entrepreneurial mentoring and a lack of funding. Furthermore, other authors deem business support services critical in converting ideas to viable businesses (Bruneel et al., 2012; Chan & Lau, 2005); hence the following null hypothesis, based on research question two and the findings in literature was formulated;

H_{02} *There is no relationship between the business support services provided by UTBIs and the performance of their tenant firms*

2.4.3 UTBI Services – Access to networks

Access to networks refers to the social networks created by incubatees either internal within a business incubator or external with other actors outside of the incubator (Wachira et al., 2016). Access to networks especially with partners external to the incubator is thought to stimulate collaboration and access to resources that the incubator is unable to provide directly (Bruneel et al., 2012). Moreover, Wachira et al (2016) explain, in their study of UBIs in Kenya, that social networks had a significant positive impact on the growth of tenant enterprises. The dimensions of social networks can be measured in terms of the strength of the ties (weak or strong), the nature of the networks (internal or external) and the frequency of use of these networks (Ebbers, 2014; Mcadam & Marlow, 2007). This study focuses on only external networks since past studies have shown that they show stronger correlation with performance than internal networks (Akçomak, 2011; Chan & Lau, 2005; Wachira et al., 2016).

2.4.3.1 Networking with the business community

This refers to networks to industry and/or business professionals. Access to networks of business professionals give start-ups access to resources that they cannot afford to

pay for (for example professionals who deal with intellectual property protection) and to external business stakeholders whose participation in the incubator uplifts the image of tenant firms and gives them legitimacy in the industry (Bruneel et al., 2012; Peters et al., 2004). In addition, these business contacts could become key partners to the start-ups in the form of either suppliers and/or customers and help them overcome the liability of newness associated with new enterprises (Bruneel et al., 2012).

2.4.3.2 Networking with universities and research community

Lindelöf & Löfsten (2004) point out that tenants in UTBIs and Science Parks have access to the university faculty, staff and research networks that the host university may be a part of as well as to the greater research community. They argue that these networks could potentially provide tenants access to advanced research centres and research staff that may help increase their level of innovation via increased R&D collaboration.

2.4.3.3 Networking with financiers

This refers to access to networks of business angels and venture capitalists. Aerts, Matthyssens, & Vandenbempt (2007) explain that BIs offer funding indirectly to tenant firms by brokering access to networks of financiers who provide funds which are important in the early-stages of tenant firms. Moreover, venture capitalists often provide oversight once they have invested in a nascent firm and this promotes the development of the start-up by lending the venture capitalist experience to the start-up to help mature their organizational and managerial processes (Bruneel et al., 2012; Hellmann & Puri, 2002). In addition, access to financiers is a critical success factor for digital entrepreneurs in Kenya (Drouillard et al., 2014).

2.4.3.4 Research Hypothesis H03

According to Wachira et al. (2016), a single increase in access to networks creates a 81% improvement in performance. Moreover, other studies such as Akçomak (2011) and Grimaldi & Grandi (2005) show that access to external networks positively impact the performance of tenant firms. Hence the following null hypothesis, based on research question three and the literature findings, was formulated;

H_{03} *There is no relationship between access to networks, as a service provided by UTBIs and the performance of their tenant firms*

2.4.4 Performance of Digital enterprises

Mian (2014), explains that the success of an UTBI can be assessed based on four main dimensions; the growth and sustainability of the incubation program; the tenant firms' survivability and growth; the contributions to the hosting university's mission and benefits to the community where the UTBI is domiciled. These performance indicators drawn largely from the assessment framework developed in 1997 by Professor Mian, have been used successfully in past studies (Mian, 2014; Mian et al., 2012); Löfsten & Lindelöf, (2002) adopted it to assess new technology based firms in science and technology parks in Sweden and Akçomak & Taymaz, (2007) used it to assess TBIs in Turkey. In this study, the focus was on how services provided by incubators affect tenant firm growth in terms of sales growth, employment growth and product innovation.

2.4.4.1 Sales Growth

This refers to the increase in revenue over time. Amezcua (2010) argues that it is a favoured metric for entrepreneurs since revenue growth is a measure of enterprise sustainability. However, it is a difficult metric to measure since most firms consider actual sales figures too sensitive to share and are more willing to state if their sales increase or not after incubation (Wachira et al., 2017b).

2.4.4.2 Employment Growth

This is the increase in the number of jobs that the enterprise creates over time. While this in a sense is an input side metric, it an important performance metric since policymakers are keen to measure the employment creation aspect of business incubation (Amezcua, 2010). In addition, from a university perspective it is important to gauge if the incubator is creating employment opportunities for its students, R&D staff and academic staff as this is often cited as one of the benefits to the hosting university (Bathula, Karia, & Abbott, 2011; Mian, 2014). Moreover, in 2014 it was noted that the jobs created were predominantly in technical roles in comparison to managerial and business job roles (Drouillard et al., 2014).

2.4.4.3 Product Innovation

This metric measures the level of innovativeness of a firm in terms of number of new products and services introduced for a given period, how often new products or services or new product or service features (also referred to as product updates) are introduced for a given period (also known as the product release cycle), the novelty of the product and ownership of patents and trademarks and other forms of intellectual property (Ensley & Hmieleski, 2005; Lindelöf & Löfsten, 2004). It is included in this study as part of the dependent variable since university value add services such as R&D facilities and staff consultants is thought to directly increase the quantity and quality of products for tenant firms in UTBIs (Lindelöf & Löfsten, 2004). While the number of intellectual property registered is an important dimension to measure innovation, Ensley & Hmieleski, (2005) and Lindelöf & Löfsten, (2004) warn that their absence do not necessarily imply a low level of innovation. Sometimes incubator managers especially in university incubators discourage their tenant firms from protection their innovations and instead urge them to focus on growing the sales of their business (Lindelöf & Löfsten, 2004). That is why this study included other measures of innovation such as number of new products within one year and the product release cycle. The higher the number of products released and the shorter the product release cycle the higher the level of product innovation. These measures have yielded good results in past studies and shown consistency in measuring the level of product innovation (Galindo-rueda & Van Cruysen, 2016).

2.4.5 The Role of Government and Entrepreneurial Culture

As discussed in section 2.2, government has historically played an important moderating role in fostering the performance of technology intensive firms. Firstly, is the creation of supportive policies that promote the conversion of innovation into viable businesses. For example, in the US, this was the enactment of the Bayh-Dole act that allowed federally funded universities to commercialize university research; in India it was the setup of NSTED and the STEP program that targeted the commercialization of university research (Mowery & Sampat, 2004; Thillairajan & Jain, 2013). In Kenya, the plan to create a national framework of incubator would provide the policies UTBIs require in order to be successful (ICTA, 2014).Secondly, the government plays a key role in provision of risk capital which is critically

important in Kenya where the macroeconomic environment, like that of other emerging markets, is volatile and makes raising capital particularly difficult for start-ups (Akçomak, 2011; Drouillard et al., 2014). Hence the availability of the YEFD and WEFD although not reserved exclusively for technology-oriented firms, is a step in the right direction.

In addition, entrepreneurial culture also plays a role in promoting digital enterprises. Lalkaka (2002) posits that a risk-taking culture is necessary for incubators to succeed, especially when this risk-taking is in response to meet local needs, and attributes this as one of the factors that made Silicon Valley in San Francisco, USA a success. Akçomak (2011) posits that a risk-averse culture in China inhibits the effectiveness of incubator services. Moreover, in Africa tech hubs have played an important role in promoting a technology-oriented entrepreneurial culture by providing platforms where diverse technology enthusiasts, entrepreneurs, venture capitalists and other stakeholders can meet and exchange ideas on a regular basis (Kelly & Firestone, 2016).

2.4.6 Do University Technology Business Incubator Services have an impact?

Amezcua (2010) in a study of BIs between 1990 and 2009 in US argues that there is overwhelming evidence that business incubated in university-sponsored incubators reported higher levels of performance; they had a 17 per cent lower likelihood of failure; experienced 370 per cent higher sales growth and recorded 200 per cent more employment growth than tenants in incubators not sponsored by a university. Although, the study does not distinguish between general UBIs and UTBIs, this finding is consistent with the growth reported by the Mian as cited by Akçomak, (2011) in 1996 and 1997 studies of US UTBIs. Generally, there is evidence that firms in university-affiliated incubators perform better in terms of revenue and employment growth than non-incubated firms (Akçomak & Taymaz, 2007; Colombo & Delmastro, 2002; Lindelöf & Löfsten, 2002, 2004, Löfsten & Lindelöf, 2001, 2002). Löfsten & Lindelöf (2001, 2002) and Lindelöf & Löfsten (2002, 2004) conducted detailed researches comparing on-incubator and off-incubator performance for firms in science parks affiliated to universities in Sweden using samples of 250 on-park and off-park firms between 1994 and 1998. While Lindelöf & Löfsten (2002) concentrated on growth, management and financing of NTBFs and the how science parks add value in

these dimensions, Löfsten & Lindelöf (2002) focused on academic-industry links, innovation and marketing and their effect on the growth of firms in science parks. These researches were important to this study, since firstly they are similarities in terms of how the dependent variables have been operationalized in terms of sales growth, employment growth and product innovation. Another important research is Akçomak & Taymaz, (2007) who compared the performance of firms in UTBIs in Turkey and non-incubated firms. Akçomak & Taymaz (2007) and Wachira et al. (2017b), difficulties in getting precise sales and employment figures and the workarounds that worked, informed the research design of this study to look for relative increases or decreases in employment and sales growth to address privacy concerns of respondents who did not wish to share actual sales or employment records.

Akçomak, (2011) who analysed the extant literature in 2009 on business incubation posits that some value-added services affect some dimension of performance more than others (see table 2.2) with the conclusion that networking with businesses and financial support make the broadest positive contribution to the performance of the tenant firm.

Table 2.1 Summary of findings from literature on incubator performance

Performance Indicator / Value-added Contribution	Survival	Sales Growth	Employment Growth	Innovativeness
Physical Infrastructure	P	P/O	O	O
Management Support	P/O	O	O	O
Administrative Support	P/O	O	O	O
Incubator Image	P	P/O/N	O	O
Financial Support	P/O	P/O	P/O	O
Networking with University	O	O	O	P/O
Networking with Business	P/O	P/O	P/O	P/O
Networking with incubatee firms	O/N	O/N	O/N	O/N

Notes: P – Positive effect, O- No effect, N- Negative effect

Source: Akçomak (2011)

2.4.7 Past Studies of Incubation in Kenya

While there have been a number of studies in incubation in Kenya, Wachira et al. (2017b), is foundational to this study because it is studied UBIs in all six universities

that offered business incubation. The study targeted all 59 start-ups that had graduated from UBIs and sought to establish a relationship between the role of university business incubator strategy and enterprise growth. The study analysed the impact of five independent variables namely, social networks strategy, incubate selection strategy, managerial skills impartation strategy, entrepreneurial skills impartation strategy and incubator environment. The dependent variable was enterprise growth measured in terms of product innovation, growth of sales and growth of employment. This study bore semblance to Wachira et al. (2017b) but differed in that it focused only on technology-focused incubators, considered only technology-intensive firms and took a resource-based view of the services provided by the UTBI. Other important researches are Meru & Struwig, (2011, 2015) that justify the use of tenant view points and not that of the management of incubators since the studies established that managers of incubators tend to overstate the benefits they give their tenant firms. Another important study is Drouillard et al., (2014) that is a report on the Kenya digital entrepreneurship landscape that highlights the potential as well as challenges of this sector. One of the latent challenges – the significant mismatch between high innovation and low successful commercialization of these innovations is a core issue that this study examined further in a UTBI context. Kelly & Firestone, (2016) is another study of tech hubs in Africa and reiterates the continent's unfulfilled potential (Kenya included) in taking full advantage of digital technologies to build vibrant digital based businesses and the resultant impact on the economy.

2.5 Conclusion

2.5.1 Summary of key limitations and research gaps

In the review of literature, the participation of universities is mostly a given, with authors such as Lalkaka (2002) pointing out that a knowledge base in the form of a university is one of the five key pillars required for the success of TBIs. However, most of these studies are either in developed countries or in developing countries that have a markedly difference macroeconomic environment than Kenya. Furthermore, their forage into UTBIs began much earlier; US in 1951, Brazil and India in 1980s and Turkey in 1990s; meaning they have had time to learn from their mistakes (Akçomak & Taymaz, 2007; Bathula et al., 2011; Chandra, 2007; Chandra & Chao, 2011; Mian, 2011). Sá, (2015) posits that lack of funding of universities in Africa,

cultural differences, negative perceptions on the part of industry in Africa and lack of institution leadership and research capacity reduce the impact and efficacy of university-industry linkages in Africa, which is key for the success of UTBIs. Tamásy, (2007) casts doubt on the efficacy of business incubation as a policy tool arguing that the laudatory examples of Stanford park and Research Triangle are exceptions and not the norm and that it would take a hundred years to replicate the same success elsewhere. In addition, some authors posit that academic entrepreneurship and commercialization of research is often at cross-purposes of the primary function of universities which is to create open knowledge to better society and often there is a mismatch of priorities, mindsets and schedules between industry and academics (Mian, 2011; Mowery & Sampat, 2004). Regarding the value-added services – there are contradictions from literature. While Chan & Lau (2005), argue that rent breaks are valuable for nascent firms, Akçomak & Taymaz (2007) posits that they are not. Chan & Lau (2005) argue that entrepreneurs of are subject matter experts with little need for technical training Drouillard et al. (2014) and Peters et al. (2004) argue that technical training is still important. Moreover, even though Lindelöf & Löfsten (2004) and Ensley & Hmieleski (2005) agree that UTBIs improve the level of innovation (but not necessarily the number of patents), there is disagreement if this translates to higher profitability. While Amezcua (2010) argues it does Lindelöf & Löfsten (2002, 2004) argue that it does not and call for further research. Moreover, with the advent of open innovation, researchers such as Guerrero et al. (2016) and Tamásy (2007) argue that the path to innovation is not necessarily linear – that is from university research to industry.

2.5.2 Summary of key findings

The performance measures of a UTBI can be assessed on various dimensions but the focus of this study was to assess the tenant firm's growth or what the study refers to as performance and will consider three attributes; growth of sales, growth of employment and level of product innovation (Mian, 2014). Drawing from resource-based view theory and social capital theory, several value-added services are thought to be responsible for the performance of nascent digital firms; these services are grouped into three - technological support, business support and access to networks (Bruneel et al., 2012; Grimaldi & Grandi, 2005; Mcadam & Marlow, 2007; Somsuk

et al., 2010). Technological support refers first to infrastructure such as work space, office equipment and shared resources and includes R&D facilities and secondly, it also refers to technical training (Hackett & Dilts, 2004; Peters et al., 2004). Business support services refer to business training, entrepreneurship mentoring, and funding which are core services offered by BIs including UTBIs (Bruneel et al., 2012). Lastly, access to networks refers to external social networks, networks to the business community, networks to universities and the research community and networks to financiers – networking is thought to play a vital role in access to professionals and business services beyond what the UTBI can provide; access to advanced R&D capabilities beyond those of the host university and access to funding from business angles and venture capitalist (Aerts et al., 2007; Bruneel et al., 2012; Lindelöf & Löfsten, 2004; Mian, 2011, 2014; Mian et al., 2016). The government plays a moderating role in promoting new venture success by providing supportive policies and risk capital (Akçomak, 2011; Mowery & Sampat, 2004). Moreover, an entrepreneurial culture is thought to enhance the impact of UTBI services (Lalkaka, 2002; Mian et al., 2010). Past studies have shown than UTBI services contribute positively to growth of sales and employment of their tenant firms compared to non-incubated firms (Akçomak, 2011; Akçomak & Taymaz, 2007; Colombo & Delmastro, 2002). Some authors such as Amezcua (2010) using empirical evidence posits that tenant firms in UBIs even outperform tenant firms in non-university affiliated BIs in terms of growth of sales and growth of employment. Furthermore, Ensley & Hmieleski (2005) and Lindelöf & Löfsten (2004) concur that firms incubated in universities demonstrate a higher degree of product innovation.

2.5.3 Summary of Research Hypotheses

The following statistical null hypotheses based on the research questions and the review of literature were formulated and used in the study to answer the research objectives of the study.

H_{01} *There is no relationship between the technological support services provided by UTBIs and the performance of their tenant firms*

H_{02} *There is no relationship between the business support services provided by UTBIs and the performance of their tenant firms*

H_{03} *There is no relationship between access to networks, as a service provided by UTBIs and the performance of their tenant firms*

2.6 Conceptual Framework

Figure 2.1 presents a conceptual model that summarizes the literature that has been reviewed. It defines the dependent and independent variables and shows the relationship between them. It also shows the role played by intervening variables. In this study, the independent variables were technology support services, business support services and access to networks. The dependent variable was performance of digital enterprises. The intervening variables were Government support and Entrepreneurial culture.

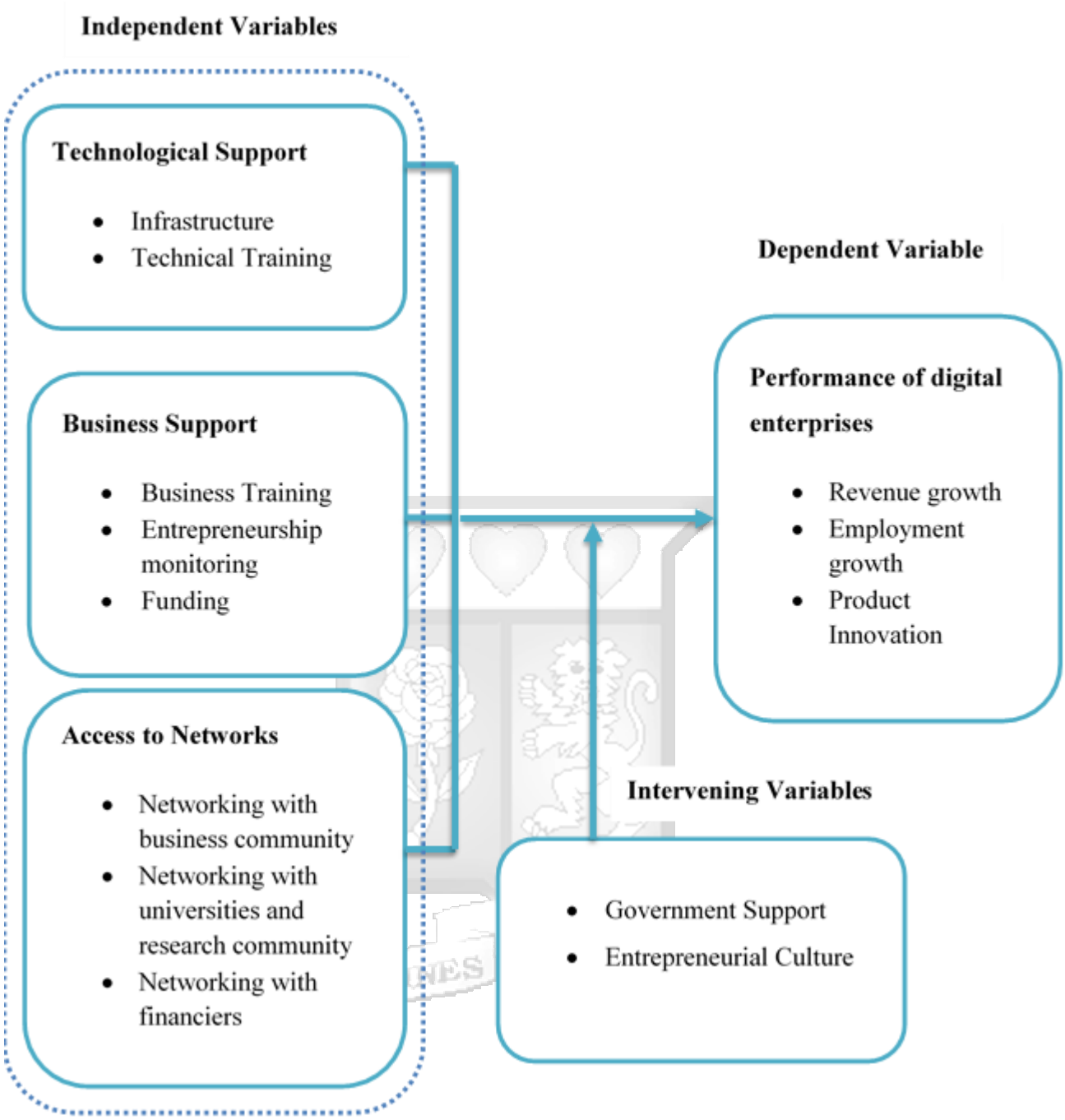

Figure 2.1 Conceptual Framework

Source: Author

2.6.1 Measurement of Variables

Technological support services were evaluated by assessing the usage of infrastructure – that is physical facilities and undertaking of technical training. Business support services were evaluated based on training on business skills (such as marketing, accounting, business plan preparation, intellectual property protection and people management), entrepreneurship mentoring and funding through indirect funding. Access to networks were evaluated by the strength of ties and frequency of interaction with networks of business professionals, financiers and university staff and faculty. The performance of digital enterprises was measured based on the net increase/decrease in sales, net increase/decrease in jobs and product innovation was measured on the number of new products released in the market, number of intellectual property rights and the product release cycle.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This section describes the research design, population and sampling method and the data collection methods that were used in this study and in each case, provides justifications for the selection. In addition, it explains how the data was analysed to test the research hypothesis and how research quality and ethical considerations were upheld.

3.2 Research Design

A research design may be defined as a plan of how the objectives of a research study are met and the specific issues under investigation or the plan to organize and collect data with the purpose of actualizing research (Kothari, 2004). The research design was descriptive as it aimed to assess the effect that UTBI services have on the performance of digital enterprises. The study aimed to describe the characteristics of the UTBI services, the performance of digital enterprises as well as explain the nature of relationships between them as they currently exist. According to Saunders, Lewis, & Thornbill, (2016) a descriptive research design approach is suitable when a research aims to get an accurate picture of the phenomenon being studied. Moreover, a descriptive study is more than data collection but also involves "measurement, classification, analysis, comparison and interpretation of data" (Kombo & Tromp, 2006, p. 71). The data analysis method was quantitative. The study was cross-sectional and communicative and used surveys for data collection.

3.3 Population and Sampling

3.3.1 Study Population

The unit of analysis was digital entrepreneurs who had graduated from UTBIs in Kenya. This meant that all digital entrepreneurs who have graduated from all Universities Business Incubators formed the study population. An initial list was developed from past studies such as Wachira et al. (2016). Although there is no official sampling frame for university incubators the list of approved universities, provided by Commission for University Education (CUE) was used and yielded a total of 48 public and private chartered universities (CUE, 2017a). Using personal networks and internet

searches for incubators in Kenya a list of eight universities was developed and is shown in table 3.1

Table 3.1 List of University Business Incubators in Kenya

Item No.	Name of University	Name of Incubator	Location
1	Strathmore University	iBizAfrica	Nairobi
2	Kenyatta University	Chandaria Business Innovation and Incubation Centre	Nairobi
3	University of Nairobi	C4Dlab	Nairobi
4	Jomo Kenyatta University of Agriculture and technology	Nairobi Industrial and Technology Park (NITP)	Juja
5	Kenya College of Accountancy University	Business Incubation Centre	Nairobi
6	Technical University of Kenya	Business/Technical Incubation Unit	Nairobi
7	Mount Kenya University	Business Incubation Centre	Thika
8	Dedan Kimathi University of Technology	DeHub	Nyeri

Source: Adapted from Wachira et al. (2016)

3.3.2 Target Population

The target population was identified by looking at which university incubators meet the necessary criteria for it to be considered a UTBI. Beyond offering incubation, the incubator needed to meet two addition conditions. First, was the ability to offer technical training as part of the incubation program (Mian, 2014). Secondly, for an incubator to qualify as a UTBI the hosting university should be a research university (Guerrero et al., 2016; Mian, 2011, 2014). In a Kenyan context, universities are not

classified as research universities or non-research universities – they are simply universities. However, a rudimentary check for research capacity was to check if the university offered a Commission of University Education approved Master or Doctorate degree program in technology – that is computer science, IT or an ICT related field, consistent with the definition of technology in this study – as one of the requirements of these programs is empirical research (CUE, 2017b). The requirement for the university to have research capacity is to ensure that the incubator has access to the right level of subject-matter expertise in the host university to nurture the technology-based start-ups that needs assistance to not only master the skill of converting their innovation to a commercial product but also cope with the pressure of a changing business environment (Chen, 2009; Mian, 2014). Furthermore, due to time and costs constraints only universities in Nairobi and its environs were included in the study. Out of the initial eight universities, six met the eligibility criteria, but one Mount Kenya university was excluded because of its location. The five universities in Nairobi and its environs were engaged as part of this study, firstly to understand how they operate and secondly to provide a list of digital entrepreneurs who had graduated from these incubators. A digital entrepreneur here is one whose start-up aimed to monetize ICT-based and mobile-money based innovations. The table 3.2 shows the population of digital entrepreneurs who had graduated from UTBIs in Kenya that were the target population for this study.

Table 3.2 List of UTBIs and their digital entrepreneur graduates

Item No	University Name	Name of Incubator	Number of Digital Entrepreneurs Graduated
1	Strathmore University	iBizAfrica	40
2	Kenyatta University	Chandaria Business Innovation and Incubation Centre	11
3	University of Nairobi	C4Dlab	5
4	Kenya College of Accountancy University	Business Incubation Centre	1
5	Jomo Kenyatta University of Agriculture and Technology	Nairobi Industrial and Technology Park (NITP)	1
	Total Number of Graduates		**58**

Source: Author

3.3.3 Sampling Technique

As the number of respondents was not large a census approach was adopted; all 58 respondents were contacted to participate in the study. The assessment of sales growth and product innovation included all products that the start-up offered to market. A census approach is feasible and suitable for answering research questions if the entire population is a manageable size (Saunders et al., 2016).

3.4 Data Collection Methods

The main instrument for data collection was a semi-structured questionnaire. According to Saunders et al (2016), a questionnaire is a low cost and convenient data collection tool when the questions for each respondent are the same. The questionnaire incorporated closed questions with nominal and ordinal scales as well as several open-ended questions. Only primary data from the questionnaire was used in this study. In addition, face-to-face interviews and telephone interviews were conducted with the management of UTBIs, to ascertain eligibility as well as gain access to their tenant

firms. All respondents were contacted by email as this was the contact method that UTBIs management preferred to share. Personal networks were used in some cases to get physical address contacts and mobile numbers. Hence the survey was approximately 50% self-completed and administered on the Internet using an online survey tool SurveyMonkey. The rest of the respondents who did not respond to email preferred to respond either on phone or face to face. According to Saunders et al. (2016), Internet questionnaires are low cost, have automated data input and have a low likelihood of contamination or distortion of the respondent answers. However, the response rate is usually lower than that of telephone and face-to-face interviewer completed questionnaires. To overcome the low response rate, respondents were sent personalised emails addressing them by name with multiple follow-up emails using an automated tool SalesHandy that also tracked who had responded to the survey. On the other hand, interview-completed questionnaires are more susceptible to distortion of the respondents answer and are more time consuming (De Vaus & de Vaus, 2013). To overcome this distortion, answers were repeated to respondents to make sure the answers were accurate and represented the respondents' views.

3.5 Data Analysis

Data collected via questionnaires was analysed to obtain descriptive statistics- that is the central tendencies and dispersion characteristics, were applicable, for the independent and dependent variables. The data was presented using tables, bar charts and pie charts to describe the various constructs of the independent and dependent variables. Inferential statistics using the Spearman's rank correlation coefficient (also known as Spearman's rho) was used to test the research hypothesis H_{01}, H_{02} and H_{03} in this study. According to Hauke & Kossowski (2011), Spearman's rho is suitable for testing relationships between variables firstly, because it does not make any assumptions about the normality of the data, secondly it is suitable for data collected using ordinal scales and thirdly, like the Pearson's Product Moment Correlation Coefficient (PMCC) is able to assess the direction and strength of the relationship between the variables; it however, does not imply a linear relationship between the two variables as does PMCC.

3.6 Research Quality

3.6.1 Pilot Study

Since the study used a single method of data collection it was critical that the questionnaire have high validity and reliability. To this end, a pilot study was done using six respondents from the target population, who did not take part in the final study. The aim of the pilot was to test the suitability of the structure of the questionnaire, the flow of the questionnaire, identify elements that could have introduced bias and errors, test the time for completing the questionnaire and highlighted general areas for improvement in the actual survey.

3.6.2 Reliability

Reliability refers to the quality and consistency of the measurement instrument (Cooper & Schindler, 2011). To test the internal consistency of information given in the questionnaire a Cronbach alpha test was done. These tests were performed on the pilot study with six responses since according to Kothari (2004), five to ten percent of the target sample size is adequate for testing reliability. Cronbach's alpha coefficient tests was performed where a value of $\alpha = 0.7$ or greater indicated the questions combined in the scale were measuring the same thing and is acceptable for general studies (Saunders et al., 2016).

The cut-off value of 0.7 as the base required alpha value was met by all scales. The Cronbach alpha test was carried out on the responses on the pilot study. The results are shown in table 3.3

Table 3.3 Results of Cronbach Alpha Tests

Variable	Cronbach alpha	Comment
Technological support services	0.875	Acceptable
Business support services	0.956	Acceptable
Access to networks	0.916	Acceptable
Performance of digital enterprises	0.952	Acceptable

3.6.3 Validity

Validity refers to the extent to which a tool can measure what it was intended to measure. Orodho (2009) states that validity of a research instrument is the degree to which results obtained from the analysis of the data represent the phenomenon under investigation. To ensure high validity the questionnaire was reviewed by two experts in the incubation field for content and construct validity. In addition, some control questions and reverse worded questions were included in the questionnaire to ensure the respondent read each question carefully before answering. Only four questions in total were reverse worded, and only in matrix-style questions. The cautious use of reverse worded questions has been shown to reduce acquiesce or response set especially to matrix-style questions (Weijters & Baumgartner, 2012). To ensure external validity descriptions of the research questions design, findings, interpretations and analysis have been fully documented and disclosed in this study to enable the reader to judge the transferability of this study to another area of their choosing (Saunders et al., 2016). Lastly, feedback from the pilot study was used to improve the quality of the questions. Some questions were removed, others added while the wording of others was simplified to achieve better validity.

3.7 Ethical Considerations

Data was collected after formal informed consent has been given from the management of the UTBIs and verbal informed consent from the respondents. This informed consent included information on the aim and purpose of the study, the rights of the respondents including rights to refuse participation as well as partial participation. In addition, respondents were informed on how long it would take to complete the questionnaire. Information on anonymity and confidentiality was also shared to ensure respondents had confidence in the data collection process and acted normally. Anonymity and confidentiality was maintained by not collecting respondents' names, organisational affiliation as well as grouping of the collected data. The author also ensured that beneficence was upheld and that respondents were treated with respect.

CHAPTER FOUR: PRESENTATION OF RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the research findings of this study and is organised into three main sections. The first section presents the study response rate and demographic statistics of the respondents. The second presents descriptive statistics of the data collected and correlational tests that were carried out to test the relationships between technological support services, business support services and access to networks on the one hand and on the other performance of digital enterprises. The chapter concludes by summarizing the main research results.

4.2 Response Rate

The study administered a total of 58 questionnaires. A total of 46 respondents responded to the questionnaire representing a response rate of 79.3% as shown in table 4.1. According to Cooper & Schindler (2011) response rates above 50% are acceptable for analysis and publishing, 60% is good, 70% is very good while 80% and above is excellent. The responses also included six partial responses that were maintained as part of the study. This is because, firstly, they gave an accurate picture of digital enterprises in Kenya without skewing the data in any manner. Secondly, only complete responses were considered in the correlation tests that were used to test the research hypotheses in this study.

Table 4.1 Response Rate

Response	Frequency	Percentage
Responded	46	79.3%
Not Responded	12	20.7%
Total	**58**	**100%**

4.3 Demographic Statistics

4.3.1 Age

Most of the respondents (60.9%) were between the ages of 26 and 35 years. This is depicted in figure 4.1. The category of 26 to 35 years was also the modal category.

This finding is consist with Drouillard et al. (2014) who explain from their study that 86% of digital entrepreneurs are below 35 years. However, the findings are contrary to Wachira et al. (2017b) who found that in 2017, 80.9% of the graduates from university incubators were between the ages of 18-25 years. The difference could be partly explained by the one-year difference between the studies that coincided with the one-year difference between the upper and lower boundary of the two age categories.

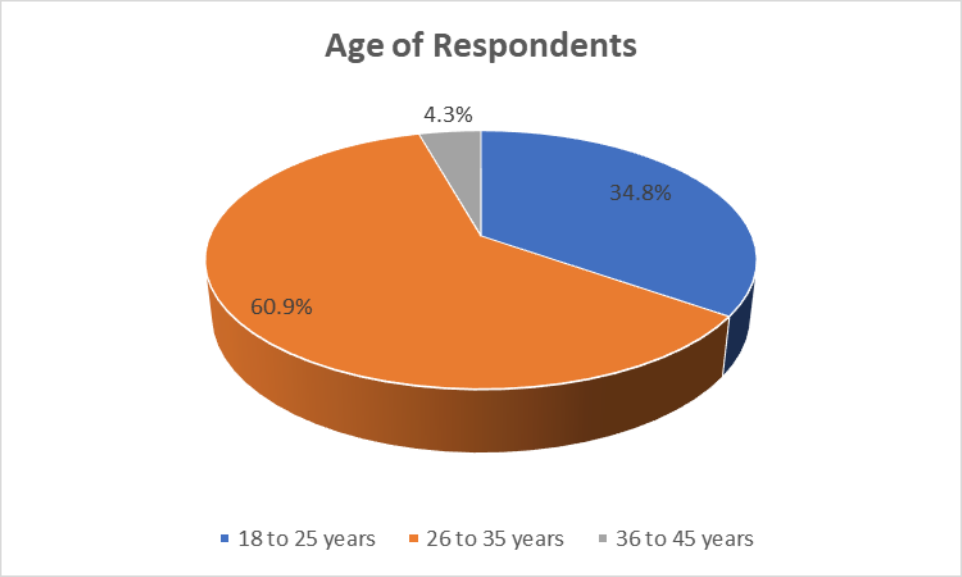

Figure 4.1 Age of Respondents

4.3.2 Gender

Most of the respondents were male constituting 76.1% of the respondents. Only 11 respondents were female constituting 23.9% of the respondents. This is depicted in figure 4.2. Drouillard et al. (2014) explain that in 2014, 90% of digital entrepreneurs were male, while Wachira et al. (2017a) found that 80.9% of university incubator graduates were male consistent with the findings in this study. Karanja as cited in Wachira et al. (2017b), explains that the predominantly male participation in entrepreneurship is due to culture where the man is viewed as both financier and owner of most enterprises.

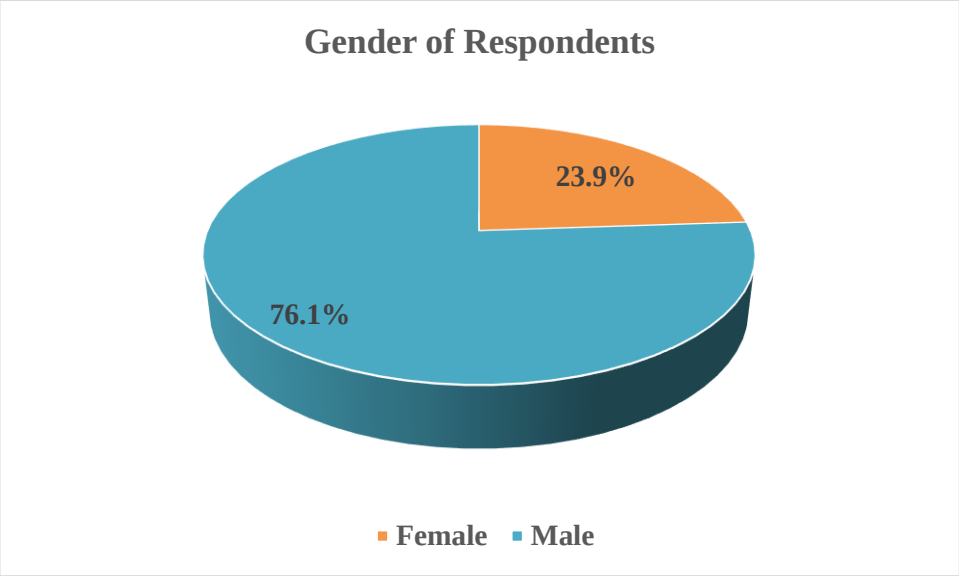

Figure 4.2 Gender of Respondents

4.3.3 Education background

Most respondents had at least a bachelor's degree constituting 91.3% of the respondents. This is depicted in table 4.2. The bachelor's degree was the modal category with a frequency of 32 respondents or 69.6%. This finding is consistent with past studies that show that the Kenyan entrepreneur is well endowed academically with majority having at least a bachelor's degree (Drouillard et al., 2014; Wachira et al., 2017b).

Table 4.2 Highest Level of Education Completed

Highest Education Level Completed	Frequency	Percentage
Bachelor's Degree	32	69.6%
Master's Degree	9	19.6%
Doctorate	1	2.2%
Tertiary	3	6.5%
Secondary	1	2.2%
Total	**46**	**100%**

4.3.4 Incubation Period

The duration of stay in the incubators varied significantly. Table 4.3 provides a summary of responses in this section whereas figure 4.3 provides a box plot indicating the distribution of the data.

Table 4.3 Incubation Period

Statistic	**Incubation Period** (Rounded in months)
Median	11 months
Mean	17 months
Variance (n-1)	228 months
Standard deviation (n-1)	15 months
Skewness (Pearson)	1.313

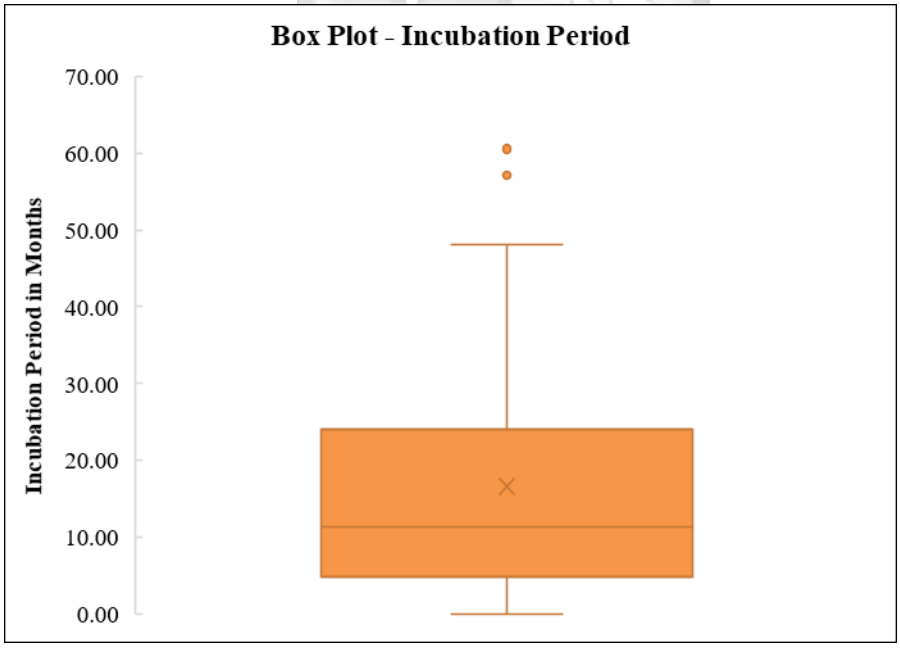

Figure 4.3 Box Plot of Incubation Period

The mean incubation period was 17 months although the data presented a standard deviation of 15 months and a Pearson skewness coefficient of 1.313 thereby indicating that the mean was not an accurate indicator of the central tendency of the data. The median, chosen as the alternative measure, was 11 months. The high variance on incubation period is consistent with Wachira et al. (2017), who posit that demand for incubation is high and the capacity of the incubator is limited and hence entrepreneurs are not able to get extended residency in the incubator, should they fail to meet certain progress milestones.

4.3.5 Nature of Business

The respondents had a very wide breath of ICT related companies, though this does not necessarily represent unique companies. However, the three most common areas of business were eLearning, software development and payment systems, reflecting, 17.39%, 13% and 8.7% respectively of the respondents. This is depicted in table 4.4. The wide variety of technology companies lends credence to the fact that incubators need to network and work together as ICTA, (2014) proposes in the Kenya ICT national masterplan as it is doubtful if a single university incubator has the capacity to provide subject matter expertise in all these areas.

Table 4.4 Description of Respondents' Business Areas

Nature of Business	Frequency	Percentage
Communications	2	4.35%
Fleet Management Services	2	4.35%
Digital Advisory Services	2	4.35%
Social Media Services	2	4.35%
Multimedia and Film	3	6.52%
Payment Systems	4	8.70%
eLearning services	6	13.04%
Software Development	8	17.39%
Others ICT Product and Services	17	36.96%
Total	**46**	**100%**

4.3.6 Main Technology Area

The main technology area had both internet-based and Mobile-based applications in responses assessing the main technology area among respondents. The group had 25 respondents – 54.4% of total responses and majority of the respondents (63.1%) main technology area was mobile-based only or mobile and Internet-based. This is depicted in table 4.5 and the result is consistent with Drouillard et al. (2014), who posits that the mobile is the platform of choice for digital entrepreneurs.

Table 4.5 Main Technology Area

Main Technology Area	Frequency	Percentage
Both Internet-based and Mobile-based application	25	**54.4%**
Internet-based - Web Application only	15	**32.6%**
Mobile-based - SMS, USSD, IVR, Android/IOS App only	4	**8.7%**
Other	2	**4.3%**
Total	46	**100%**

4.4 Research Findings -Technological Support Services

4.4.1 Descriptive Statistics - Infrastructure

Most respondents either agreed or strongly agreed to the statement that the physical facilities provided were critically important in the early stage of the start-up constituting 81.4% of respondents. The modal category was strongly agreed with a modal frequency of 27. This is depicted in table 4.6. This is consistent with Chan & Lau (2005) who posits that rent-free workspaces are very valuable to early stage start-ups.

Table 4.6 Use and Importance of Infrastructure

Statements on Infrastructure	Response				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
The physical facilities such as work-spaces were critically important in the early days of my start-up	2.3%	4.7%	11.6%	18.6%	62.8%
Access to university laboratories and/or scientific equipment was very important for my product research and development	14%	16.3%	18.6%	32.6%	18.6%
I rarely used the university laboratories and/or scientific equipment	20.9%	18.6%	4.7%	34.7%	20.9%

While, 51.2 % of the respondents either agreed or strongly agreed with the statement that access to laboratories and/or scientific equipment was very important for their research and development only 39.5% either strong disagreed or disagreed to the statement that they rarely used the university laboratories and/or scientific equipment.

This inconsistency in response was not noted in the respondents who were interviewed face-to-face or on the phone or in the pilot study. Hence, due to the reverse wording on the question on use of university laboratories it was concluded that this was a response error with the respondents completing the survey online not being very attentive to the wording of the question. As such responses to this question were not considered further in this study and were not used to answer the research objectives.

However, the responses as shown in table 4.6 are consistent with Lindelöf & Löfsten (2004) and Mian (2014) studies that found access to university laboratories and scientific equipment valuable and important for the tenant's firm research and development.

4.4.2 Descriptive Statistics - Technical Training

Technical training was important to the respondents with 34.9% indicating it was very important and 41.9% indicating it was extremely important. This is depicted in figure 4.4. This was consistent with Drouillard et al. (2014) who posit that training is still important to digital entrepreneurs and was contrary to Chan & Lau, (2005) who posit that founders of technology-intensive firms are experts in their areas of innovation and require no technical training.

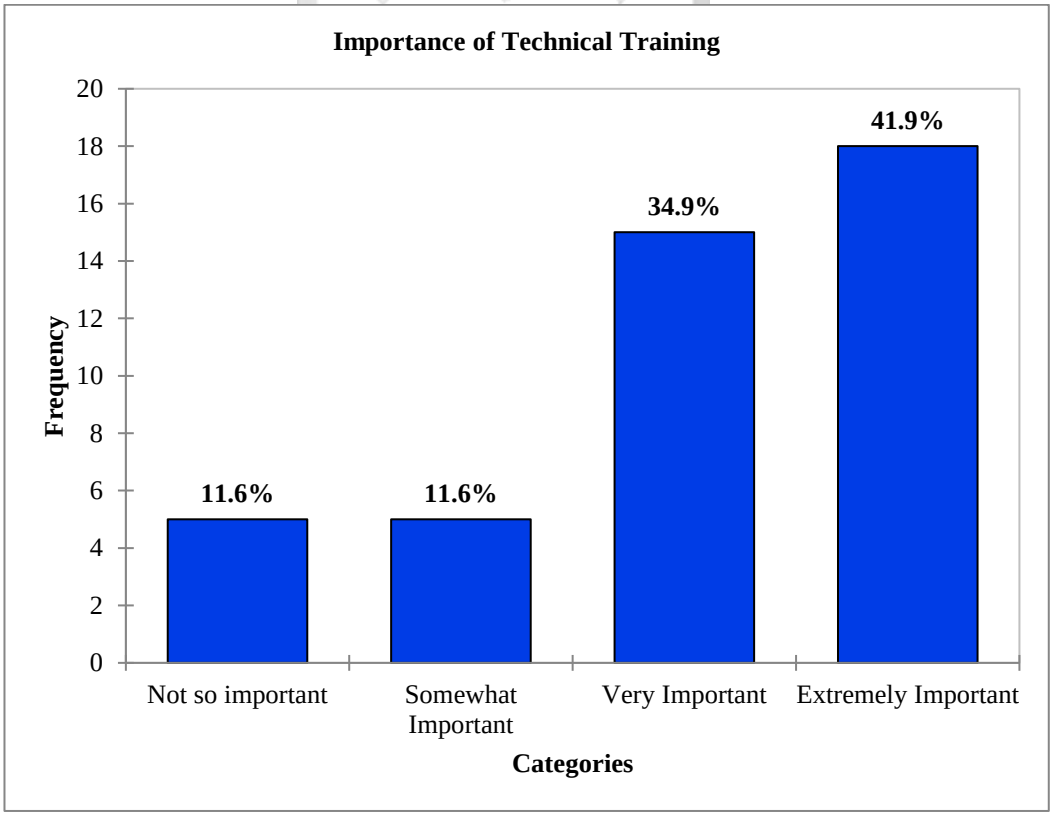

Figure 4.4 Importance of Technical Training

Regarding the relevance of technical training 51.2% of the respondents either could not say or disagreed that with the statement that technical training was relevant to their innovation and 55.8% of respondents either could also not say or disagreed to the statement that the university faculty were subject-matter experts in their area of innovations. This is depicted in table 4.7. In both questions "can't say" was the modal category with 17 out of 43 respondents who responded to this question. Both these responses are contrary to the response given by 81.4% of respondents who rated technical training as either very important or extremely important. This points to the fact that respondents indicated that relevant technical training in their respective innovation areas was not provided. This is contrary to Mian (2014) and Mian et al. (2012) who posit that one of the key differentiators of UTBIs is their ability to provide technical training and bring knowledge capital to their tenant firms.

Table 4.7 Relevance and quality of technical training

Statements on Technical Training	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
The technical training provided was relevant to my innovation	7%	4.7%	39.5%	30.2%	18.6%
The university faculty were subject-matter experts in my innovation area	7%	9.3%	39.5%	25.6%	18.6%

4.4.3 Correlational Analysis – Test of Research Hypothesis H_{01}

Spearman's rank correlation coefficient tests were used to test the relationships between the independent and dependent variables as part of the inferential statistical analysis. The tests used a 0.01 level of significance unless otherwise stated. A 0.01

level of significance indicates that there is only a 1% chance that the relationship occurs by chance or that the results represent a 99% level of confidence that the outcome is not by chance. According to Bishara & Hittner (2012), a spearman's rank correlation of above 0.4 is considered valid in inferring correlation between variables; this was used as the base cut off in assessing valid correlations between the variables. In addition, a co-efficient between 0.4 and 0.6 indicates a moderate positive correlation and a coefficient between 0.6 and 0.8 indicates a strong positive correlation (Saunders et al., 2016).

Spearman's rank correlation was used to test the null hypothesis H_{01}

H_{01} *There is no relationship between the technological support services provided by UTBIs and the performance of their tenant firms*

Table 4.8 depicts the results of the correlation test. This result indicated there was no significant relationship between technological support services and the performance of digital enterprises since the p value of 0.304 was greater than the 0.01 level of significance. Hence there was insufficient evidence to reject the null hypothesis H_{01}

Table 4.8 Correlational Analysis - Technological Support Services

Spearman's rho		**Performance of Digital enterprises**
Technological Support	Correlation Coefficient	0.155
	Sig. (2-tailed)	0.304
	N	46

A spearman's rank correlation was also run to establish the relationship between the variables under the dimension technological support – infrastructure and technical training – and those of the dependent variable, performance – growth of sales, employment growth, product innovation.

The results depicted in table 4.9, indicated that there was no significant relationship between infrastructure and technical training on the one hand and growth of sales, employment growth and product innovation on the other. In all cases the p value was greater than a 0.01 level of significance. While, at a 0.1 level of significance technical training showed significant correlation with product innovation, the strength of the relationship indicated by the coefficient was below the 0.4 cut-off level.

These findings are contrary to Akçomak, (2011) who posit that physical facilities or infrastructure have a positive effect on the growth of sales. Moreover, the finding are also contrary to Mian, (2014) and Mian et al. (2012) who posit that infrastructure and technical training are important and valuable services provided to tenant firms and are thought to contribute to the performance of technology-intensive firms.

Table 4.9 Correlational Analysis – Infrastructure and Technical Training

Spearman's rho		**Growth of Sales**	**Employment growth**	**Product Innovation**
Infrastructure	Correlation Coefficient	0.019	0.102	-0.001
	Sig. (2-tailed)	0.901	0.499	0.996
	N	46	46	46
Technical Training	Correlation Coefficient	0.133	0.241	0.284
	Sig. (2-tailed)	0.379	0.107	**0.055**
	N	46	46	46

4.5 Research Findings - Business Support Services

4.5.1 Descriptive Statistics - Business Training

A simple majority of the respondents (46.5%) strongly agreed that they could prepare a business plan. Another 32.6% agreed that they could prepare a business plan.

Regarding the statement on the ability to prepare a marketing plan, 44.2% of the respondents agreed, while another 39.5% strongly agreed with this statement. In terms of the statement on not understanding the legal requirements to register their business, 41.9%, strongly disagreed and another 34.9 disagreed indicating that majority of the respondents (76.8%) understood the legal requirements to register their business. A simple majority of 41.9% agreed that they understood basic accounting and could interpret financial statements and another 37.2% strongly agreed with these two categories representing most respondents (79.1%). Most respondents (51.2%) agreed that they knew how to build and manage a high-performance team, while another 27.9% of respondents strongly agreed – hence indicating that most respondents felt they had the skills to build and manage teams. However, regarding intellectual property protection while 39.5% of respondents indicated they agreed to the statement on how to protect their innovations, 25.6% could not say or were neutral to this statement. Generally, most respondent rated their business skills very high with the modal category for each question being either agreed or strong agreed. This showed that UTBIs in Kenya are effectively providing business training, which according to Bruneel et al. (2012) is a key incubation function and vital to new technology enterprises whose founders are often technically astute but lack business skills. The relative frequency distribution on the responses on the statement on business training are depicted in table 4.10.

Table 4.10 Business Training in UTBIs

Statements on Business Training	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
I can prepare a business plan on my own	2.3%	9.3%	9.3%	32.6%	46.5%
I can prepare a marketing plan on my own	2.3%	2.3%	11.6%	44.2%	39.5%

Statements on Business Training	Response				
	Strongly Disagree	Disagree	Can't Say	Agree	Strongly Agree
I don't understand the legal requirements to register my business	41.9%	34.9%	4.7%	24.0%	4.1%
I understand basic accounting and can interpret financial statements	2.3%	4.7%	14.0%	41.9%	37.2%
I know how to build and maintain a high-performance team	0.0%	4.7%	16.3%	51.2%	27.9%
I understand how to protect my invention using patents and trademark	2.3%	11.6%	25.6%	39.5%	20.9%

4.5.2 Descriptive Statistics - Entrepreneurial Mentoring

A simple majority of the respondents (39.5%) agreed with the statement that mentoring had helped them better evaluate business opportunities for their innovation while a further 23.3% strongly agreed with this statement. Similarly, 32.6% of respondents agreed with the statement that mentoring helped them develop a profitable business model for their product or service while another 23.3% strongly agreed with this statement. A simple majority of the respondents (44.2%) agreed that mentoring pointed out weaknesses and knowledge gaps for them to address while another 30.2% strongly agreed with this statement. An equal number of respondents 13, representing 30.2% of respondents, agreed and strongly agreed with the statement that mentoring helped them refine and focus the strategy for their business. In addition,

34.9% of respondents agreed with the statement that mentoring deepened their understanding on how to grow and scale their business while another 25.6% of respondents strongly agreed with this statement. Lastly, a simple majority of 30.2% agreed that their incubator mentor regularly monitored their progress. However, 11 respondents representing 25.6% of respondents, strongly disagreed with the statement that they received regular monitoring. When requested to explain some respondents stated that the incubator, at that time was still in its infancy stages and so did not have proper monitoring processes. One respondent explained that they voluntarily opted out of the mentoring since their mentor did not understand their business. The information on the responses to statements on entrepreneurial mentoring is depicted in table 4.11.

Table 4.11 Entrepreneurial Mentoring in UTBIs

Statements on Entrepreneurial Mentoring	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
Entrepreneurial mentoring enabled me to better evaluate the business opportunities for my innovation	7.0%	11.6%	18.6%	39.5%	23.3%
The mentoring helped me develop a profitable business model for my product or service	9.3%	16.3%	18.6%	32.6%	23.3%
Entrepreneurial mentoring pointed out weaknesses and knowledge gaps for me to address	7.0%	7.0%	11.6%	44.2%	30.2%

Statements on Entrepreneurial Mentoring	Response				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
The mentoring refined and focused the strategy for my business	4.7%	16.3%	18.6%	30.2%	30.2%
The mentoring deepened my understanding on how to grow and scale my start-up	7.0%	11.6%	20.9%	34.9%	25.6%
My incubator mentor regularly monitored my progress	25.6%	9.3%	18.6%	30.2%	16.3%

Moreover, 27.9% of respondents stated that they meet their incubator mentor at least monthly while 23.3% stated they meet their mentor every week. Another 23.3% of respondents stated that they never had any contact with the incubator mentor. Further investigation revealed that some of these respondents were among the first tenants when the UTBI was in its formative stages and had not put in place regular monitoring for all it tenants. This is consistent with Mian (2011), who explains that most UTBIs management in the strive for financial sustainability often leave their clients in dire need of mentoring while they are out looking for funding. Some respondents stated that at that time what they really needed was an Internet connection and a workspace. Table 4.12 shows the frequency of incubator contact.

Like business training, most of the respondents either agreed or strongly agreed to the statements that assessed entrepreneurial mentoring.

Table 4.12 Frequency of contact with Incubator Mentor

Frequency of contact with Incubator Mentor				
Daily	**Weekly**	**Monthly**	**Longer than a month**	**Not at all**
7%	23.3%	27.9%	18.6%	23.3%

4.5.3 Descriptive Statistics - Funding

The table 4.13 depicts the responses on funding. A simple majority of 41.9% strongly disagreed with the statement that they had received any information on the Youth Enterprise Development Fund and/or the Women Enterprise Fund. A further 18.6% of respondents disagreed with this statement. Hence it can be concluded that majority (60.5%) of respondents did not have information on how to access these risk capital funds that the government has made available specifically for youth and women.

Table 4.13 Funding in UTBIs

Statements on Funding	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
The incubator provided information on how to access the Youth Enterprise Development Fund and/or Women Enterprise Fund	41.9%	18.6%	9.3%	25.6%	4.7%
The incubator facilitated sufficient contact with potential financiers for my start-up	18.6%	23.3%	27.9%	18.6%	11.6%
Statement on Funding	**Not at all helpful**	**Not so helpful**	**Somewhat helpful**	**Very helpful**	**Extremely helpful**
How helpful was your incubator management in preparing your start-up for funding	20.9%	20.9%	27.9%	25.6%	4.7%

Statements on Funding	Not at all useful	Not so useful	Somewhat useful	Very useful	Extremely useful
How useful was the incubator in helping you understand the critical areas investors look at when funding start-ups	14%	20.9%	23.3%	27.9%	14%

In addition, 27.9% of respondent were neutral or could not say if the incubator had provided sufficient contact with potential financiers. A further 23.3% disagreed with this statement. Hence most respondents (69.8%) could either not say, disagreed or strongly disagreed with this statement indicating that respondents felt that the incubator management was facilitating sufficient contact with financiers. Furthermore, 27.9% of respondents stated that the incubator management was somewhat useful in preparing their start-up for funding, while 25.6% of respondents stated that the incubator management was very helpful. Hence most of respondents (53.5%) indicated that the incubator management was useful in preparing their start-up for funding. Moreover, 27.9% of respondents stated that the incubator was very useful in helping them understand the critical areas that investor look at when funding start-ups. Another 23.3% of respondents stated that the incubator was somewhat useful. Hence it can be concluded majority of respondents (65.2%) found the incubator management useful in helping them understand investors and make their businesses more investible.

In summary UTBIs are making strides in correcting the funding deficiencies identified in Drouillard et al. (2014) by preparing start-ups for funding and in helping digital entrepreneurs understand what investors look for when funding digital start-ups. However, gaps persist regarding sufficient contact with financiers and information on how to access YEDF and WEFD.

4.5.4 Correlational Analysis – Test of Research Hypothesis H_{02}

Spearman's rank correlation was used to test the null hypothesis H_{02}

H_{02} There is no relationship between the business support services provided by UTBIs and the performance of their tenant firms

The results depicted in table 4.13 indicated a significant correlation between business support services and the performance of digital enterprises at a 0.01 level of significance. Hence there was sufficient evidence to reject the null hypothesis $H_{02.}$ In addition, the coefficient indicated a strong positive relationship between business support services and the performance of digital enterprises.

Table 4.14 Correlational Analysis - Business Support Services and Performance

Spearman's rho		**Performance of Digital enterprises**
Business Support Services	Correlation Coefficient	**.607****
	Sig. (2-tailed)	0.000
	N	46
** - Correlation is significant at the 0.01 level of significance (2-tailed).		

Another spearman's rho test was also run between the three variables under the dimension business support – business training, entrepreneurial mentoring and funding and those of the dependent variable performance - growth of sales, employment growth and product innovation.

The results depicted in table 4.15 indicated a significant moderate positive correlation between business training and growth of sales, employment growth and product innovation. The results also indicated a significant moderate positive correlation between entrepreneurial mentoring and employment growth and product innovation

but no significant relationship between mentoring and growth of sales. Furthermore, the results showed a significant moderate positive correlation between funding and employment growth and a strong positive correlation with growth of sales and product innovation.

These findings are consistent with Bruneel et al. (2012) who posit that business support services are core components of any incubation program and are positively correlated with the performance of tenant firms. In addition, this is consistent with RBV theory in that resources, in this case business support services, when combined with an entrepreneurs capability are able to produce goods and services that earn revenue and increase the performance of the firm (Barney, 1991; Lendner, 2007). However, contrary to Drouillard et al. (2014), entrepreneurial mentoring had no positive impact on growth of sales. In addition, the findings only partial agree with Akçomak (2011) who argues that financial support or funding positively impact growth of sales and employment but not product innovation – in this study funding positively affects all three performance indicators.

Table 4.15 Correlational Analysis - Business Training, Mentoring, and Funding

Spearman's rho		**Growth of Sales**	**Employment Growth**	**Product Innovation**
Business Training	Correlation Coefficient	**.448****	**.541****	**.508****
	Sig. (2-tailed)	0.002	0.000	0.000
	N	46	46	46
Entrepreneurial Mentoring	Correlation Coefficient	.375*	**.412****	**.420****
	Sig. (2-tailed)	0.010	0.004	0.004
	N	46	46	46
Funding	Correlation Coefficient	**.604****	**.580****	**.627****
	Sig. (2-tailed)	0.000	0.000	0.000
	N	46	46	46
** - Correlation is significant at the 0.01 level of significance (2-tailed).				
* - Correlation is significant at the 0.05 level of significance (2-tailed).				

4.6 Research Findings - Access to Networks

4.6.1 Descriptive Statistics - Networking with Business Professionals

As depicted in table 4.16 a simple majority of 39.5% of respondents strongly agreed that networking with business professionals gave them access to resources beyond those provided by their incubator. Another 27.9% also agreed with this statement. Hence the findings here are consistent with Bruneel et al. (2012) the source of this statement.

Table 4.16 Networking with Business in UTBIs

Statements on Networking with Business	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
Networking with business professionals gave me access to resources beyond those provided by my incubator	11.6%	9.3%	11.6%	27.9%	39.5%
Networking with business professional gave me access to key business partners and professionals	11.6%	9.3%	14.0%	37.2%	27.9%
Networking with business professionals improved the image of my firm as a legitimate business	9.3%	9.3%	7.0%	39.5%	34.9%
I have a strong connection with business partners and	14.0%	16.3%	30.2%	30.2%	9.3%

Statements on Networking with Business	Response				
	Strongly Disagree	Disagree	Can't Say	Agree	Strongly Agree
professionals who are important to my business					

Regarding the extent to which networking with business gave the respondent access to key business partners and professionals, a simple majority of 37.2% agreed while a further 27.9% strongly agreed with this statement. Consistent with the assertions of Bruneel et al. (2012) and Peters et al. (2004), 39.5% of respondents agreed that networking with business improved the image of their firm and a further 34.9% strongly agreed with this statement. An equal number of respondents (30.2%) agreed that they had a strong connection to business partners and professionals as did the 30.2% of respondents who were neutral or could not say. However, majority of the respondents (69.7%) stated that they had contact with business professionals monthly or weekly or daily. While only 39.5% of respondents agreed or strongly agreed to having a strong connection to business, only 14% did not have any contact with business professionals at all. This is depicted in table 4.17. When some of the respondents available were requested to elaborate on this observation some stated that they had frequent contact with different businesses professionals and potential partners, but they could not say that their connection or relationship was strong.

Table 4.17 Frequency of contact with business professionals

Frequency of contact with business professionals				
Daily	Weekly	Monthly	Longer than a month	Not at all
9.3%	30.2%	30.2%	16.3%	14%

4.6.2 Descriptive Statistics - Networking with University

As depicted in table 4.18 a simple majority of 30.2% of respondents agreed with the statement that networking with university faculty did not increase the level of innovation for their product. A further 25.6% of respondents were neutral to this statement. However, 34.9% of respondents, as depicted in table 4.19, agreed that networking with university faculty had increased their R&D collaboration. When requested to explain this apparent contradiction, some of the respondents explained that the university faculty helped their R&D in two ways. Firstly, university faculty helped them with non-technical aspects of their business such as how to carry out a proper market research. Secondly, university faculty helped some respondents test their products with the large student population and the university itself. In addition, several respondents indicated that they had figured out their product innovation before entering the incubation program and hence did not require much assistance in terms of increasing their level of innovation.

Table 4.18 Networking with University in UTBIs

Statements on Networking with University	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
Networking with university faculty did not increase the level of innovation for my product	11.6%	20.9%	25.6%	30.2%	11.6%
Networking with university faculty facilitated increased R&D collaboration	11.6%	23.3%	25.6%	34.9%	4.7%
I have a weak connection with university faculty	7%	27.9%	25.6%	20.9%	18.6%

In addition, 27.9% of respondents disagreed with the statement they have a weak connection with the university faculty while 25.6% gave a neutral response. Slightly more respondents (39.5%) agreed or strongly agreed to this statement while 34.6% of respondents either disagreed or strongly disagreed to having a weak connection with university faculty and staff. Hence, the study concludes that a simple majority (39.5%) of respondents had a weak connection to university faculty and staff

As depicted in table 4.19, 34.9% of respondents stated that they did not have any contact with university faculty and this explains in part the relatively high neutral responses in the previous two statements.

Table 4.19 Frequency of contact with university faculty and staff

Frequency of contact with university				
Daily	**Weekly**	**Monthly**	**Longer than a month**	**Not at all**
4.7%	18.6%	27.9%	14%	34.9%

The findings in this section are consistent with Guerrero et al. (2016) who argue that the contributions of universities have been defined in very narrow technical or research-based terms; in this findings links to university faculty were valuable and important but for market research and for leveraging the university community as a readily available test bed. In addition, 34.9% of respondents reported not having any contact at all with university faculty lending credence to arguments by Mian (2011) and Mowery & Sampat (2004) on the culture, mindset and priority mismatch challenges of cohabitating entrepreneurship with research in universities.

4.6.3 Descriptive Statistics - Networking with financiers

As depicted in table 4.20, 20.9% of respondents disagreed with the statement that networking with financiers helped them obtain funding for their business. A further 18.6% strongly disagreed, while 30.2% of respondents gave a neutral response to

this statement. Hence the study concludes that a simple majority of 39.5% of respondents either disagreed or strongly disagreed with the statement that networking with financiers helped them obtain funding for their business. In addition, 30.2% of respondents gave a neutral response to the statement that they had a strong connection with financiers, while a simple majority of 48.9% either disagreed or strongly disagreed with this statement.

Table 4.20 Networking with Financiers in UTBIs

Statements on Networking with Financiers	**Response**				
	Strongly Disagree	**Disagree**	**Can't Say**	**Agree**	**Strongly Agree**
Networking with financiers helped me obtain funding for my business	18.6%	20.9%	30.2%	16.3%	14%
I have a strong connection with financiers	25.6%	23.3%	30.2%	7%	14%

Furthermore, as depicted in table 4.21, 44.2% of respondents stated they had no contact at all with financiers and another 34.9% had a frequency of contact beyond one month. Hence the study concludes that a simple majority (48.9%) have a weak connection to financiers. This is consistent with the findings of Drouillard et al. (2014) who posit that most digital entrepreneurs do not have ready access to potential financiers for their business.

Table 4.21 Frequency of contact with financiers

Frequency of contact with financiers			
Weekly	**Monthly**	**Longer than a month**	**Not at all**
7%	14%	34.9%	44.2%

4.6.4 Correlational Analysis – Test of Research Hypothesis H_{03}

Spearman's rank correlation was used to test the null hypothesis H_{03}

H_{03} *There is no relationship between access to networks, as a service provided by UTBIs and the performance of their tenant firms*

The results depicted in table 4.22 indicated a significant moderate positive relationship between access to networks and the performance of digital enterprises at a 0.01 level of significance. Hence there was sufficient evidence to reject the null hypothesis H_{03}.

Table 4.22 Correlational Analysis - Access to Networks and performance

Spearman's rho		**Performance of Digital enterprises**
Access to Networks	Correlation Coefficient	**.417****
	Sig. (2-tailed)	0.004
	N	46
** - Correlation is significant at the 0.01 level of significance (2-tailed).		

Another spearman's rho test was run between the three variables under the dimension access to networks – networking with business, networking with universities and networking with financiers and the dependent variable performance - growth of sales, employment growth and product innovation. The results depicted in table 4.19

indicated a significant moderate positive correlation between networking with the business community and growth of sales, employment growth and product innovation. The relationship was strongest between networking with business community and employment growth. The results also indicated no significant correlation between networking with universities and growth of sales, employment growth and product innovation. Furthermore, the results indicated a significant moderate positive correlation between networking with financiers and growth of sales, employment growth and product innovation, with the relationship with employment growth being the strongest.

Table 4.23 Correlational Analysis - Networking with business, university and financiers

Spearman's rho	Growth of Sales	Employment Growth		Product Innovation
Networking with business community	Correlation Coefficient	**.450****	**.517****	**.444****
	Sig. (2-tailed)	0.002	0.000	0.002
	N	46	46	46
Networking with universities and research community	Correlation Coefficient	-0.009	0.071	0.119
	Sig. (2-tailed)	0.951	0.638	0.432
	N	46	46	46
Networking with financiers	Correlation Coefficient	**.409****	**.536****	**.421****
	Sig. (2-tailed)	0.005	0.000	0.004
	N	46	46	46
** - Correlation is significant at the 0.01 level of significance (2-tailed).				

The findings in this section are consistent with Bruneel et al. (2012), who argues that networking with business community help business incubated in universities gain legitimacy, improve their image as well as overcome their liability of newness enabling the firm to grow. However, contrary to Lindelöf & Löfsten, (2004) and

Akçomak (2011) networking with university had no significant impact on product innovation. The findings also contradict Amezcua (2010) who argues that networking with universities increases not only product innovation but sales of growth and employment. In addition, consistent with past studies, the findings showed that incubators mainly provide funding by facilitating access to financiers and that this access is critical in the performance of digital enterprises in Kenya (Aerts et al., 2007; Drouillard et al., 2014). In addition, the findings are consistent with social capital theory that shows that an entrepreneurs' success depends not only on his/her activities but also on the co-operation and collaboration with others (Grimaldi & Grandi, 2005). Lastly, the overall findings on access to networks is consistent with Wachira et al. (2016).

4.7 Research Findings - Performance of Digital enterprises

4.7.1 Descriptive Statistics - Growth of Sales

As depicted in figure 4.5, a marginally higher number of respondents 35% agreed to the statement that growth of sales had increased after incubation. 32.5% of respondents gave a neutral response to this statement. However, a simple majority 50% of respondents either agreed or strongly agreed with this statement.

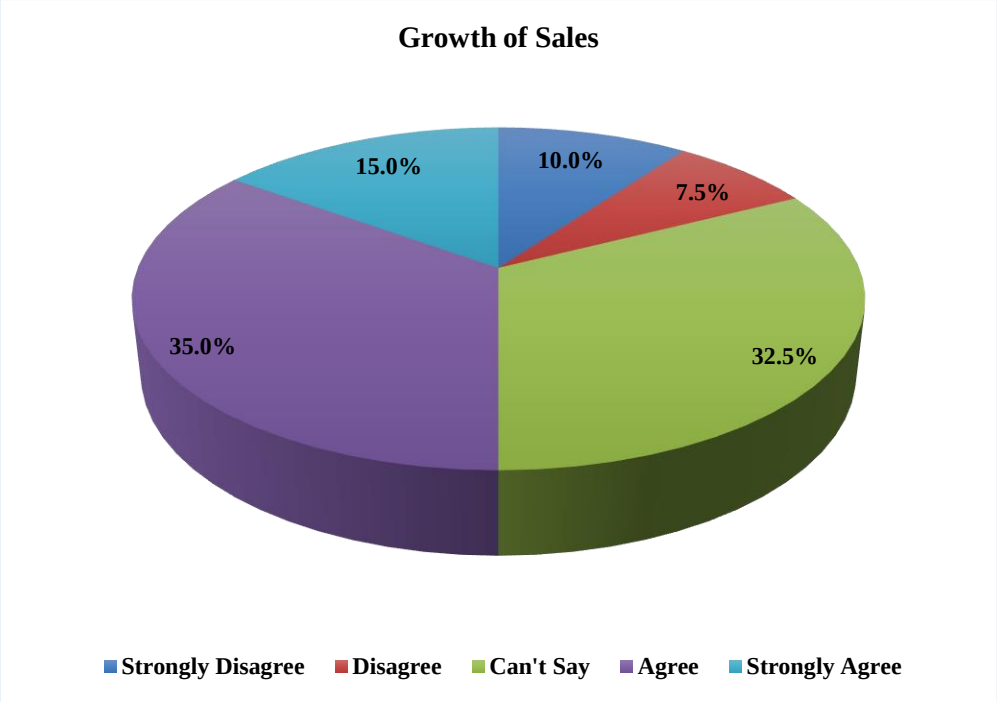

Figure 4.5 Growth of Sales

As shown in table 4.24, a quantitative analysis was done on the average annual percentage growth. The analysis showed that the percentages stated had a mean of 37.863 but a high standard deviation of 61.915

Table 4.24 Quantitative analysis of growth of sales

Statistic	Average Annual Percentage Growth
Median	15.000
Mean	37.863
Variance (n-1)	3833.525
Standard deviation (n-1)	61.915
Skewness (Pearson)	2.279

A scattergram and P-plot were used to test if the percentage growth was normally distributed. Both as depicted in figure 4.6 and figure 4.7 showed that the data had several outliers and was not normally distributed.

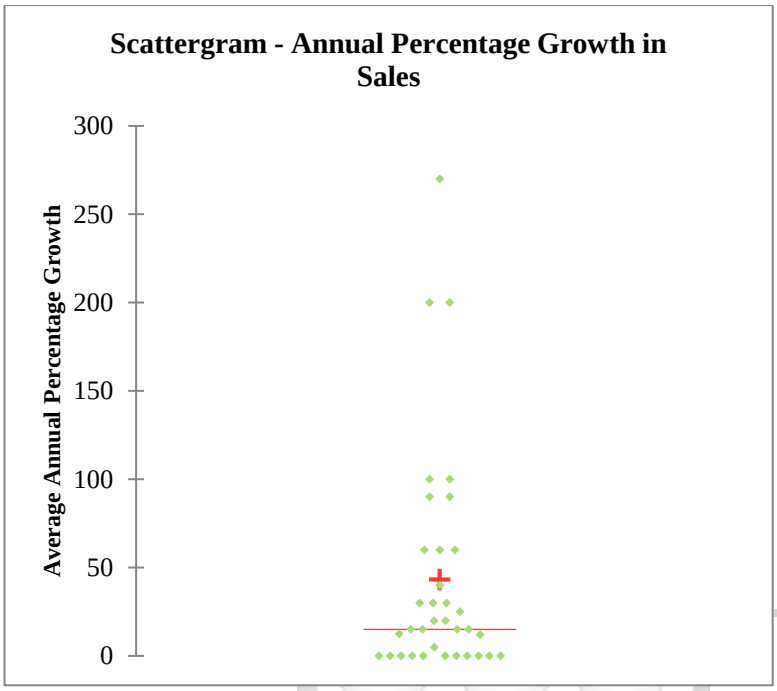

Figure 4.6 Scattergram showing distribution of percentage growth in sales

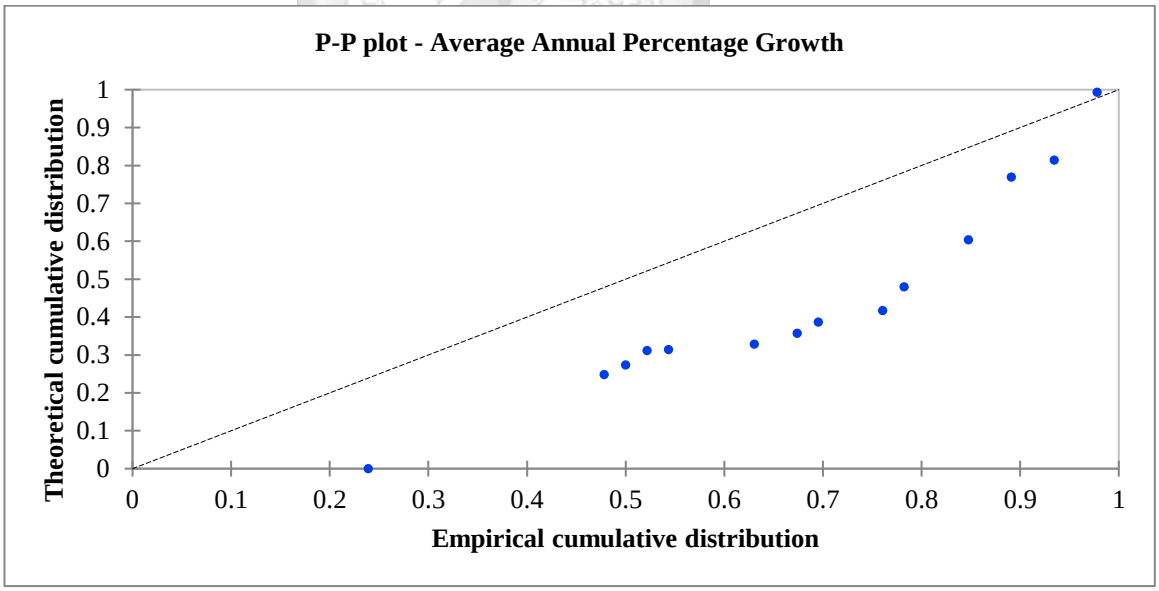

Figure 4.7 P-Plot - Distribution of Average Annual Percentage Growth in Sales

Hence the mean for the average annual percentage growth in sales was not representative of the data collected. As such a better value was the median value of 15%. As depicted in table 4.25, a qualitative analysis of the data showed that 40% of

respondents had zero percent growth which was also the modal category, while the median for growth was 15%. The analysis also showed that the percentage growth varied between 0% and 270%.

Table 4.25 Qualitative Analysis of Annual Average Percentage Growth

Annual Average Percentage Growth (%)	Frequency	Relative frequency (%)
0	**16.000**	**40.000**
5	1.000	2.500
12	1.000	2.500
12.5	1.000	2.500
15	**4.000**	**10.000**
20	2.000	5.000
25	1.000	2.500
30	3.000	7.500
40	1.000	2.500
60	3.000	7.500
90	2.000	5.000
100	2.000	5.000
200	2.000	5.000
270	1.000	2.500

4.7.2 Descriptive Statistics - Employment growth

As depicted in figure 4.8, 30% of respondents agreed with the statement that they had created new jobs after incubation. A further 22.5% of respondents strongly agreed with this statement. The study concludes that a majority (52.5%) of respondents indicated that their company had created new jobs after incubation.

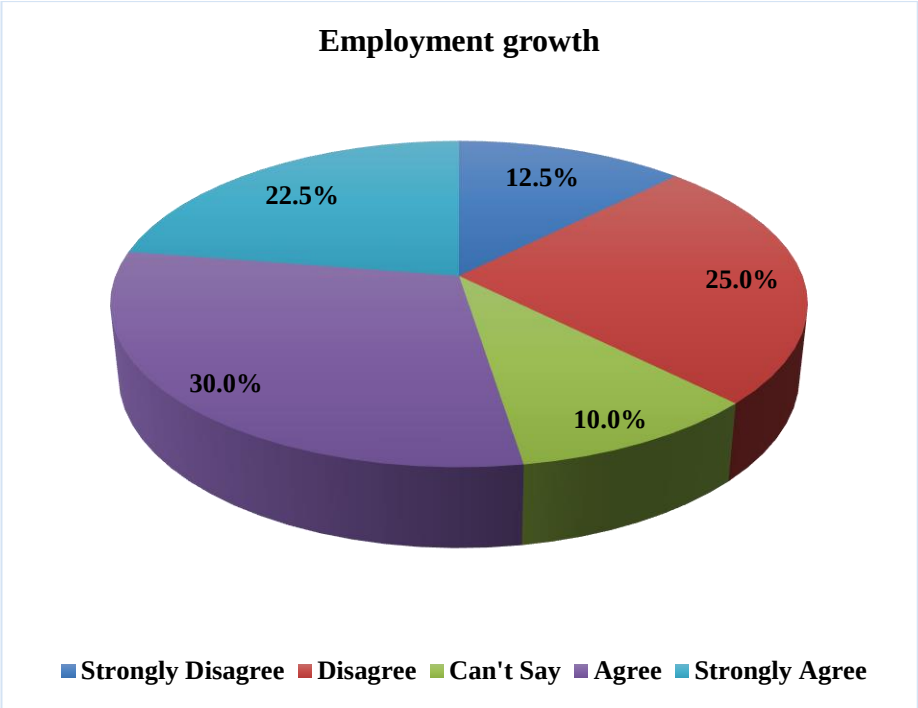

Figure 4.8 Employment growth after incubation

The table 4.26 depicts the number and type of job roles created. Only 37.5% of respondents had created one or more managerial jobs. In addition, 57.5% of respondents had created one or more technical jobs after incubation and 42.5% of respondents had created one or more business-related job after incubation. The data had some outliers with one respondent having created 47 business-related jobs. Furthermore, 45% of the respondents had created one or more contract or temporary jobs after incubation. The data had an outlier for one respondent who had created 500 temporary jobs. In total, the respondents had collectively created 199 permanent jobs and 578 temporary jobs after incubation.

Consistent with the findings by Drouillard et al. (2014) more entrepreneurs (57.2%) created technical job roles than other job roles. However, contrary to this study, in total there were more temporary (578) and business role jobs (97) than jobs in a technical role (66).

Table 4.26 Number and types of jobs created

Number of Jobs Created	Relative Frequency of Job Types				
	Management Role	**Technical Role**	**Business Role**	**Temporary/ Contract Role**	**Employees from Host University**
0	**62.5%**	**42.5%**	**57.50%**	**55.00%**	**62.5%**
1	17.5%	17.5%	12.50%	10.00%	7.5%
2	10.0%	12.5%	17.50%	10.00%	10%
3	2.5%	17.5%	5.00%	2.50%	10%
4	5.0%	5.0%		2.50%	5%
5		2.5%	2.50%	5.00%	2.5%
6				7.50%	2,5%
10	2.5%				
15		2.5%		2.50%	
16				2.50%	
20			2.50%		
47			2.50%		
500				2.50%	
Total	**100%**	**100%**	**100%**	**100%**	**100%**

As depicted in table 4.26, the incubator graduates were not contributing any new jobs to their hosting university as 62.5% of the respondents stated that none of their employees were from the host university. This is contrary to Mian (2014), who posits that one of the benefits of incubation to the host university is creation of jobs.

4.7.3 Descriptive Statistics - Product Innovation

As depicted in figure 4.9, 40% of respondents agreed to the statement that the number of products or services had increased after incubation and a further 20% strongly agreed. Hence the study concludes that a majority (60%) of respondents either agreed

or strongly agreed that the number of product or services they produced, increased after incubation.

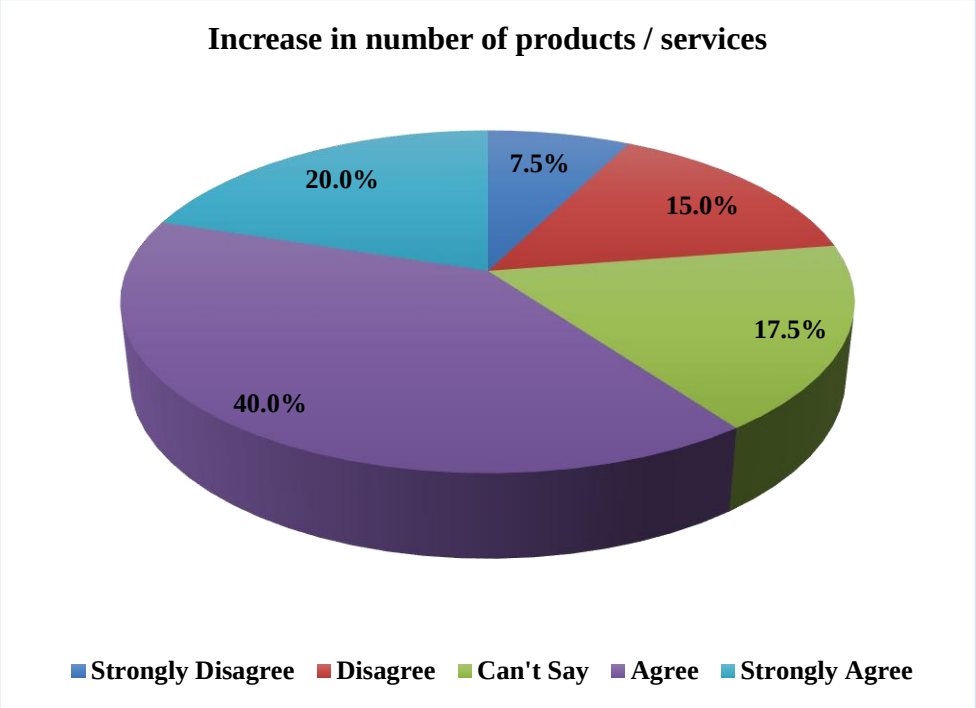

Figure 4.9 Increase in number of products / services after incubation

Figure 4.10 depicts the number of intellectual property rights registered by respondents. Only 22.5% of respondents had registered any patents. The highest number of patents held by an individual respondent was four. In addition, only 22.5% of respondents had registered any trademarks. The highest number of trademarks registered by an individual respondent was two. Moreover, only 25% of respondents held any trade secrets. One respondent reported having 100 trade secrets. However, the low number of registered intellectual property rights is not surprising. According to Lindelöf & Löfsten (2004), some incubator managers discourage their tenant firms from registering their intellectual property and instead urge them to focus on growing the sales of their business. Hence, it could be that digital enterprises do have intellectual property that they ought to protect but have decided to instead invest their energies growing the sales of their business.

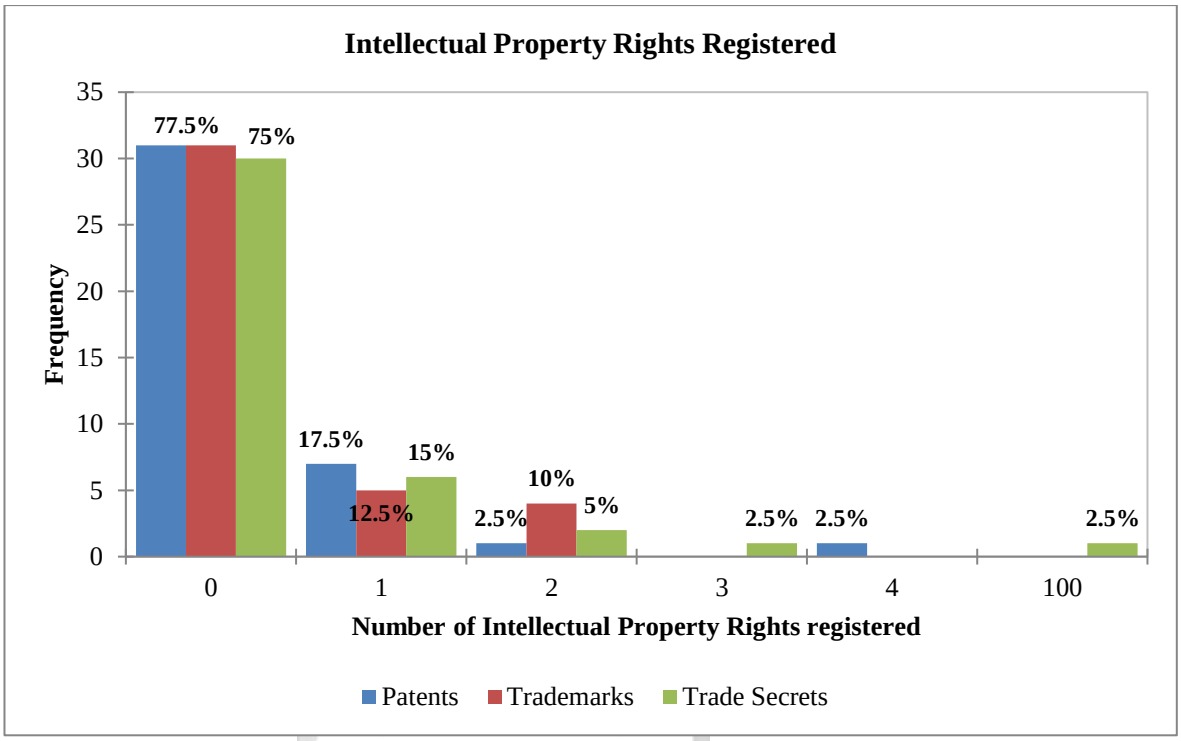

Figure 4.10 Number of Intellectual Property Rights Registered

As depicted in figure 4.11, 32.5% of the respondents stated they had released two products/ services or product updates while 30% of the respondents indicated they had released none.

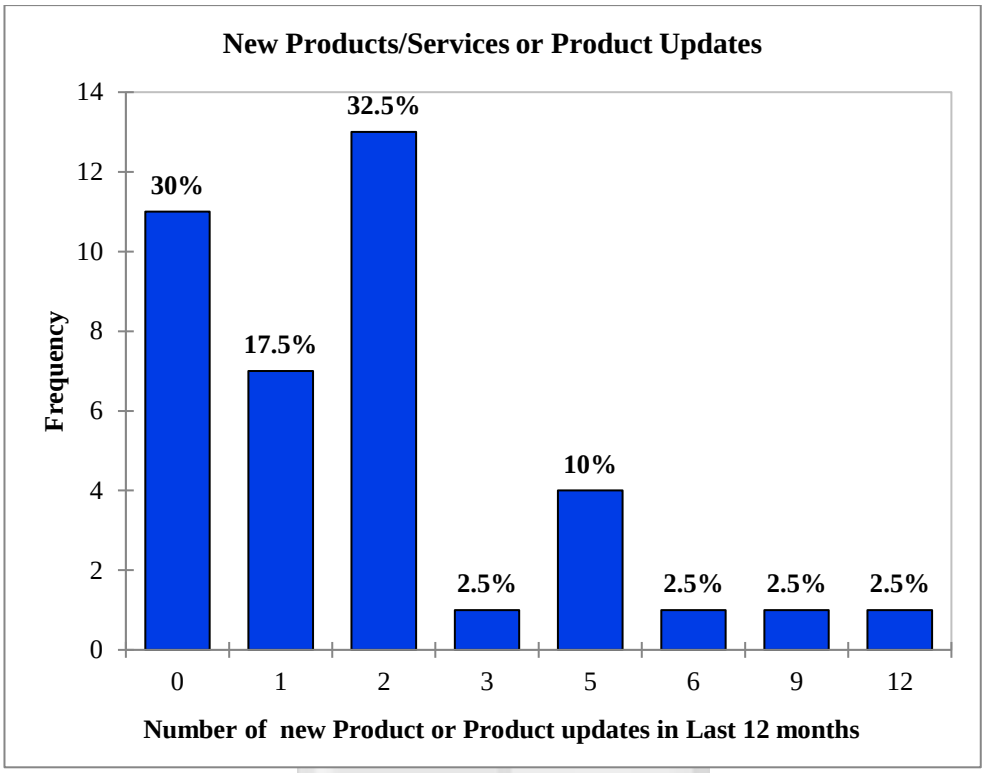

Figure 4.11 Number of New Products/Services or Updates in Last 12 months

As depicted in table 4.27, 22.5 % of the respondents indicated they were not currently releasing any new products while 20% indicated it takes 6 months to release a new feature or product update. The product release cycle varied greatly from 1 week to 24 months.

Table 4.27 Product Release Cycle in Months

Categories (Months)	Frequency per category	Relative frequency per category (%)
Product inactive	**9.000**	**22.5%**
0.25	2.000	5.0%
1	3.000	7.5%
1.5	1.000	2.5%
2	4.000	10.0%
2.25	1.000	2.5%
3	1.000	2.5%
4	1.000	2.5%
4.5	1.000	2.5%
6	**8.000**	**20.0%**
7	1.000	2.5%
10	1.000	2.5%
12	3.000	7.5%
24	1.000	2.5%
Varies	3.000	7.5%

Hence in summary majority (60%) of respondents indicated an increase in product or services released to market after incubation. A majority (70%) had released at least one new product/ service or product feature within the last 12 months and 77.5% were actively involved in releasing new products and services and had a product release cycle of between 1 week to 24 months. This indicates the presence of a certain level of product innovation with higher releases per year and short product release cycles corresponding to higher levels of product innovation (Galindo-rueda & Van Cruysen, 2016).

4.8 Summary of Research Findings

As depicted in table 4.28 technological support services had no effect on the performance of digital enterprises while both business support services and access to networks had a positive significant effect on the performance of digital enterprises.

Table 4.28 Summary of the relationships between the research study variables

Independent Variable	Effect on Dependent Variable Performance of Digital enterprises
Technological Support Services	None
Business Support Services	Positive
Access to Networks	Positive

Table 4.29 depicts the summary of the relationships for the individual variables under the independent variables technological support services, business support services, access to networks and the variables under the dependent variable performance of digital enterprises. Infrastructure and technical training had no effect on sales growth, employment growth and product innovation. Business training and funding had a significant positive effect on sales growth, employment and product innovation, while entrepreneurial mentoring had no effect on sales growth it had a significant positive effect on employment growth and product innovation. Networking with business and financiers had a positive significant effect on sales growth, employment growth and product innovation. However, networking with university had no effect on sales growth, employment growth and product innovation.

Table 4.29 Effect of UTBI Services on Performance

UTBI Services	Effect on Sales Growth	Effect on Employment Growth	Effect on Product Innovation
Infrastructure	O	O	O
Technical Training	O	O	O
Business Training	P	P	P
Entrepreneurial mentoring	O	P	P
Funding	P	P	P
Networking with business	P	P	P
Networking with university	O	O	O
Networking with financiers	P	P	P

Legend: P – Positive effect, O- No effect

Source: Author

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section discusses the main research findings of this study considering extant literature on UTBIs and summarizes how the study answered the three research objectives and makes conclusions. Lastly, it outlines recommendations, limitations of the study and highlights areas for further research.

5.2 Discussion of Findings

5.2.1 Technological support services

One of the objectives of the study was to analyse how the technological support services provided by UTBIs foster the performance of their tenant firms. The findings of the study established that there was no significant relationship between technological support services and the performance of digital enterprises. Moreover, further analysis showed that infrastructure and technical training as variables under the dimension of technological support had no significant to relationship with the growth of sales, employment growth and product innovation as the dependent variables under the dimension performance. On the one hand, majority of the respondents (81.4% and 51.2% respectively) concurred with Chan & Lau (2005) that rent breaks were very important in their firms early stages and also concurred with Mian (2014) that access to university laboratories was critically important for their product research and development. On the other hand, the findings disagree with Akçomak, (2011) that infrastructure has any significant effect on the performance of digital enterprises. In addition, the findings of this study on technical training disagree with Mian (2014) on the effect technical training has on the performance of knowledge intensive firms. Lastly, the findings are inconsistent with resource-based view theory since technological support services as a resource in combination with the capabilities of digital entrepreneurs had no impact on performance.

5.2.2 Business support services

One of the aims of the study was to determine how the business support services provided by UTBIs influence the performance of their tenant firms. The findings of

this study established that there was a significant positive relationship between business support services offered by UTBIs and the performance of their tenant firms. Furthermore, the study found out that business training and funding, two of the three variables under the dimension business support had a significant positive effect on growth of sales, employment growth and product innovation. Moreover, entrepreneurial mentoring had a significant positive effect on employment growth and product innovation but not on growth of sales. These findings are consistent with Bruneel et al. (2012) whose studies show that business training, entrepreneurial mentoring and funding have a positive effect on the performance of technology intensive firms. Moreover, the results are consistent with resource-based view theory in that business support services as a resource in combination with digital entrepreneurs' capabilities had a positive impact on performance.

5.2.3 Access to Networks

One of the objectives of this study was to assess how access to networks, as a service provided by UTBIs affect the performance of their tenant firms. The findings of the study showed that access to networks had a significant positive effect on the performance of technology-intensive firms. This is consistent with the findings of Wachira et al. (2016). In addition, the findings are consistent with social capital theory in that the success of entrepreneurs depends also on their collaboration with others (Grimaldi & Grandi, 2005).Furthermore, the study found out that networking with business community and networking with financiers had a positive effect on growth of sales, employment growth and product innovation. This is consistent with studies by Bruneel et al. (2012) and partially with Akçomak (2011). However, the studies disagree with Lindelöf & Löfsten (2004) and Mian (2014) who posit that networking with universities has a positive effect on the level of innovation of technology-intensive firms and on the general performance of technology-intensive firms.

5.3 Conclusions

The general objective of the study was to assess the effect of university technology business incubators on the performance of digital enterprises in Kenya. The findings of the study established that business support services and access to networks as a service have a significant positive effect on the performance of digital enterprises. Furthermore, the study showed that business training, funding, networking with

business and networking with financiers all had a significant positive effect on growth of sales, employment growth and product innovation. Moreover, the study found that entrepreneurial mentoring had a significant positive effect on employment growth and product innovation. Lastly, the study showed that networking with universities and technological support services had no significant effect on growth of sales, employment growth and product innovation.

5.4 Recommendations

While the study showed that UTBIs have positive impact on digital enterprises, some universities are cutting back on their incubation programs. This does not bode well with Kenya's vision to become a knowledge based economy since technology business incubators (which include UTBIs) are important innovation process enablers (Mian et al., 2010). Furthermore, UTBIs alone cannot bear the burden of creating technology-intensive forms; they require support from government in the form of supportive policies as has been evidenced in Brazil and India (Akçomak, 2011). This support could come in the actualization of the national framework of incubator as put forth in the national ICT Masterplan (ICTA, 2014). Moreover, the government needs to review the synergies created between risk capital funds such as YEDF and WEFD and UTBIs as 60.5% of respondents did not have any information on these funds while 69.8% of respondents indicated that the incubator management did not provide sufficient contact with financiers. In addition, although the study showed that UTBIs services positively influence the performance of digital enterprises, the effect is a moderate one. Only 60% of respondents reported growth in sales, less than half the respondents had created any permanent jobs and less than 25% of the respondents reported having registered any intellectual property even though 70% of the respondents were actively introducing products and /or services to market. UTBIs services across the board need strengthening so that they can have a bigger positive impact on digital enterprises in Kenya.

5.5 Limitations of the study

One limitation of the study is that it was restricted to Nairobi county due to time and costs constrains even though it studied five of the six universities that qualified as UTBIs. Secondly while there are many services that UTBIs offer, the study focused

on technological support services, business support services and access to networks. Thirdly, there are numerous performance criteria for digital enterprises as explained by Somsuk et al. (2010) but the study only focused on growth of sales, employment growth and product innovation. Moreover, the study did not explore if all three independent variables, technological support services, business support services and access to networks had a combined effect on performance of digital enterprises. Lastly, the study was limited in that it only considered digital enterprises incubated in UTBIs and not in other non-university Technology Business Incubators in Kenya.

5.6 Areas for further research

While the study established that business support and access to networks have a significant positive effect on performance of digital enterprises it would be instructive to investigate if this effect can be attributed to UTBI services only. This could be done through a comparative study where matched samples are drawn from digital enterprises that did not undergo incubation, similar to studies such as Akçomak & Taymaz (2007). The study established that technological support services did not have any significant relationship with the performance of digital enterprises. This phenomenon warrants further study as the government of Kenya is establishing Kenya's largest science and technology park, Konza city as part of the National ICT Masterplan (ICTA, 2014); it would be important to understand what aspects of technological support need to change so that infrastructure and technical training can have a significant, strong positive effect on the performance of digital enterprises. Lastly, the study established that there was no significant relationship between networking with universities, that is faculty, staff and the research community. This warrants further investigation as this study, based on extant literature took a narrow view of universities participation in largely areas of technical training and access to university laboratories and scientific equipment aimed at improving the level of innovation. A broad based exploratory study would explain how digital entrepreneurs in UTBIs benefit from the hosting university in Kenya

REFERENCES

Adegbite, O. (2001). Business Incubators and Small Enterprise Development : The Nigerian Experience. *Small Business Economics*, *17*(3), 157–166.

Aerts, K., Matthyssens, P., & Vandenbempt, K. (2007). Critical role and screening practices of European business incubators. *Technovation*, *27*(5), 254–267. https://doi.org/10.1016/j.technovation.2006.12.002

Akçomak, I. S. (2011). Incubators as Tools for Entrepreneurship Promotion in Developing Countries. In A. Szirmai, W. Naude, & M. Goedhuys (Eds.), *Entrepreneurship, Innovation, and Economic Development*. Oxford: Oxford University Press.

Akçomak, I. S., & Taymaz, E. (2007). Assessing the Effectiveness of Incubators : The Case of Turkey. In V. Venkata Ramani & A. V. Bala Krishna (Eds.), *Business Incubation: An Introduction* (pp. 234–265). Hyderabad: Icfai Books, Icfai University Press.

Albritton, F. P. (2006). Humboldt's Unity of Research and Teaching: Influence on the Philosophy and Development of U.S. Higher Education. https://doi.org/10.2139/ssrn.939811

Amezcua, A. S. (2010). *Boon or Boondoggle? Business Incubation as Entrepreneurship Policy*. Syracuse University.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120.

Bathula, H., Karia, M., & Abbott, M. (2011). *The Role of University-Based Incubators in Emerging Economies* (Working Paper No. 22).

Battelle. (2007). *Characteristics and Trends in North American Research Parks: 21st Century Directions*. *Battelle Technology Partnership Reports*. Washington, DC: Association of University Research Parks.

Bishara, A. J., & Hittner, J. B. (2012). Testing the significance of a correlation with

nonnormal data: comparison of Pearson, Spearman, transformation, and resampling approaches. *Psychological Methods*, *17*(3), 399.

Bruneel, J., Ratinho, T., Clarysse, B., & Groen, A. (2012). The evolution of Business incubators: Comparing demand and supply of business incubation services across different incubator generations. *Technovation*, *32*(2), 110–121. https://doi.org/10.1016/j.technovation.2011.11.003

Bwisu, H. (2005). The Kenyan Experience in Business Incubators. In *A Paper presented at Jomo Kenyatta University of Agriculture & Technology Workshop, 12th-14th, May 2005,Garden Hotel*. Machakos, Kenya.

CAK. (2017). First Quarter Sector Statics Report for the Financial Year 2017 / 2018 (July-September 2017). Retrieved February 26, 2018, from http://ca.go.ke/images/downloads/STATISTICS/Sector Statistics Report Q2 2017-18.pdf

Chan, K. F., & Lau, T. (2005). Assessing technology incubator programs in the science park: The good, the bad and the ugly. *Technovation*, *25*(10), 1215–1228. https://doi.org/10.1016/j.technovation.2004.03.010

Chandra, A. (2007). *Approaches to Business Incubation: A Comparative Study of the United States, China and Brazil* (2007-WP-29). Indianapolis.

Chandra, A., & Chao, C. A. (2011). Growth and evolution of high-technology business incubation in China. *Human Systems Management*, *30*(1–2), 55–69. https://doi.org/10.3233/HSM-2011-0739

Chen, C.-J. (2009). Technology commercialization, incubator and venture capital, and new venture performance. *Journal of Business Research*, *62*(1), 93–103. https://doi.org/10.1016/j.jbusres.2008.01.003

Clarysse, B., & Bruneel, J. (2007). Nurturing and growing innovative start-ups: the role of policy as integrator. *R&D Management*, *37*(2), 139–149.

Colombo, M. G., & Delmastro, M. (2002). How effective are technology incubators? *Research Policy*, *31*(7), 1103–1122. https://doi.org/10.1016/S0048-

7333(01)00178-0

Cooper, D. R., & Schindler, P. S. (2011). *Business research methods* (11th Ed.). New Delhi: McGraw-Hill Publishing, Co. Ltd.

Cornell, INSEAD, & WIPO. (2013). *The Global Innovation Index The Local Dynamics of Innovation.* Ithaca Fontainebleau and Geneva.

Cornell, INSEAD, & WIPO. (2017). *The Global Innovation Index 2017: Innovation Feeding the World*. Ithaca Fontainebleau and Geneva.

CUE. (2017a). Accredited universities in Kenya - March 2017. Retrieved March 31, 2018, from http://www.cue.or.ke/images/docs/Accredited_Universities_in_Kenya_November_2017.pdf

CUE. (2017b). Approved Academic Programs offered in chartered universities in Kenya in accordance with the Universities Act. Retrieved March 17, 2018, from Commission for University Education - Approved Academic Programmes - Academic Programmes Approved by the Commission for University Education.html

De Vaus, D., & de Vaus, D. (2013). *Surveys in social research*. Routledge.

Drouillard, M., Taverner, D., Willamson, C., & Haris, M. (2014). Digital Entrepreneurship in Kenya 2014. Retrieved September 21, 2017, from https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/02/Digital-Entrepreneurship-in-Kenya-2014.pdf

Ebbers, J. J. (2014). Networking behavior and contracting relationships among entrepreneurs in business incubators. *Entrepreneurship Theory and Practice*, *38*(5), 1159–1181.

EC. (2002). *Benchmarking of Business Incubators*. Kent. https://doi.org/10.1007/BF02629471

Ensley, M. D., & Hmieleski, K. M. (2005). A comparative study of new venture top management team composition, dynamics and performance between university-

based and independent start-ups. *Research Policy*, *34*(7), 1091–1105. https://doi.org/10.1016/j.respol.2005.05.008

Etzkowitz, H. (2002). Incubation of incubators: innovation as a triple helix of university–industry–government networks. *Science and Public Policy*, *29*(2), 115–128.

Etzkowitz, H., de Mello, J. M. C., & Almeida, M. (2005). Towards "meta-innovation" in Brazil: The evolution of the incubator and the emergence of a triple helix. *Research Policy*, *34*(4), 411–424.

Feldman, M. (2003). Entrepreneurship and American Research Universities: Evolution in technology transfer. In D. Hart (Ed.), *The Emergence of Entrepreneurship Policy: Governance, Startups and Growth in the US Knowledge Economy*. Boston, MA: Cambridge University Press.

Fukuyama, F. (1995). *Trust: The social virtues and the creation of prosperity.* London: Penguin Publications.

Galindo-rueda, F., & Van Cruysen, A. (2016). *Testing innovation survey concepts, definitions and questions: Findings from cognitive interviews with business managers*. Paris, OECD.

Gassmann, O., & Becker, B. (2006). Towards a Resource-Based View of Corporate Incubators. *International Journal of Innovation Management*, *10*(1), 19–45.

GOK. (2007). The Kenya Vision 2030. The Popular Version. Retrieved September 21, 2017, from http://www.vision2030.go.ke/cms/vds/Popular_Version.pdf

GOK. (2008). Deploying World Class Infrastructure Facilities & Services: Enablers and Movers. Retrieved September 24, 2017, from http://www.vision2030.go.ke/enablers-macros/

Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. *Technovation*, *25*(2), 111–121. https://doi.org/10.1016/S0166-4972(03)00076-2

Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Mian, S. A. (2016).

Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Business Economics*, *47*(3), 551–563. https://doi.org/10.1007/s11187-016-9755-4

Hackett, S. M., & Dilts, D. M. (2004). A Systematic Review of Business Incubation. *Journal of Technology Transfer*, *29*, 55–82. https://doi.org/10.1023/B:JOTT.0000011181.11952.0f

Harwit, E. (2002). High-technology incubators: Fuel for China's new entrepreneurship? *China Business Review*, *29*(4), 26–29.

Hauke, J., & Kossowski, T. (2011). Comparison of values of Pearson's and Spearman's correlation coefficients on the same sets of data. *Quaestiones Geographicae*, *30*(2), 87–93.

Healy, A., Perkmann, M., Goddard, J., & Kempton, L. (2014). Measuring the impact of university-business cooperation. *European Union Final Report*, 100. https://doi.org/NC-02-14-337-EN-N

Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start-up firms: Empirical evidence. *The Journal of Finance*, *57*(1), 169–197.

ICTA. (2014). The Kenya National ICT Masterplan 2014-2017. Retrieved September 21, 2017, from http://icta.go.ke/pdf/THE NATIONAL ICT MASTERPLAN 2017.pdf

Ikiara, K. (1988). The Role of Government Institutions in Kenya's Industrialization in Kenya. In P. Coughlin & G. K. Ikiara (Eds.), *Industrialization in Kenya: In Search of A Strategy.* Nairobi: East African Educational Publishers Ltd.

InBIA. (2015). InBIA: Global Network of Enterpreneurial Ecosystem Builders. Retrieved September 24, 2017, from https://inbia.org

Kaburi, S. N., Mobegi, V. O., Kombo, A., Omari, A., & Sewe, T. (2012). Entrepreneurship Challenges in Developing Economies: a case of Kenyan Economy. *International Journal of Arts and Commerce*, *1*(4), 264–274.

Kelly, T., & Firestone, R. (2016). How Tech Hubs are helping to Drive Economic

Growth in Africa. Retrieved September 21, 2017, from http://pubdocs.worldbank.org/pubdocs/publicdoc/2016/1/895381452529897772/WDR16-BP-How-Tech-Hubs-are-helping-to-Drive-Economic-Growth-in-Africa-Kelly-Firestone.pdf

Kombo, D. K., & Tromp, D. L. A. (2006). *Proposal and Thesis Writing*. Nairobi: Paulines Publications Africa.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Lalkaka, R. (2002). Technology business incubators to help build an innovation-based economy. *Journal of Change Management*, *3*(2), 167–176. https://doi.org/10.1080/714042533

Lendner, C. (2007). University technology transfer through university business incubators and how they help start-ups. In F. Thérin (Ed.), *Handbook of Research on Techno-entrepreneurship* (pp. 163–169). Cheltenham, UK: Edward Elgar.

Library House. (2006). *The impact of the University of Cambridge on the UK economy and society*. Library House Ltd.

Lindelöf, P., & Löfsten, H. (2002). Growth, management and financing of new technology-based firms-assessing value-added contributions of firms located on and off Science Parks. *Omega - The International Journal of Management Science*, *30*(3), 143–154. https://doi.org/10.1016/S0305-0483(02)00023-3

Lindelöf, P., & Löfsten, H. (2004). Proximity as a resource base for competitive advantage: University-industry links for technology transfer. *The Journal of Technology Transfer*, *29*(3–4), 311–326.

Ling, F. M., Zhen-Jun, Y., Gui-Lan, D., Bao-Fu, H., Shao-Hua, L., Xiao-Lin, W., … Kun, W. (2007). Promoting Business and Technology Incubation for Improved Competiveness of Small and Medium-sized Industries Through Application of Modern and Efficient Technologies in China. In V. Venkata Ramani & A. V. Bala Krishna (Eds.), *Business Incubation: An Introduction* (pp. 196–223).

Hyderabad: Icfai Books, Icfai University Press.

Löfsten, H., & Lindelöf, P. (2001). Science parks in Sweden - industrial renewal and development? *R&D Management*, *31*(3), 309–322. https://doi.org/10.1111/1467-9310.00219

Löfsten, H., & Lindelöf, P. (2002). Science Parks and the growth of new technology-based firms—academic-industry links, innovation and markets. *Omega*, *30*(3), 143–154. https://doi.org/10.1016/S0305-0483(02)00023-3

Luo, G.-F., & Huang, W.-L. (2008). A multi-stage model for evaluating new technology-based firms' innovation resource on the view of venture capital. In *Machine Learning and Cybernetics, 2008 International Conference on* (Vol. 7, pp. 4074–4079). IEEE.

Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal*, *13*(5), 363–380.

Mason, C., & Brown, R. (2014). Entrepreneurial ecosystems and growth oriented entrepreneurship. *Final Report to OECD, Paris*, *30*(1), 77–102. https://doi.org/10.4337/9781785364624

Mcadam, M., & Marlow, S. (2007). Building Futures or Stealing Secrets?: Entrepreneurial Cooperation and Conflict within Business Incubators. *International Small Business Journal*, *25*(4), 361–382. https://doi.org/10.1177/0266242607078563

McAdam, M., & McAdam, R. (2008). High tech start-ups in University Science Park incubators: The relationship between the start-up's lifecycle progression and use of the incubator's resources. *Technovation*, *28*(5), 277–290. https://doi.org/10.1016/j.technovation.2007.07.012

Meru, A. K., & Struwig, M. (2011). An Evaluation of the Entrepreneurs' Perception of Business-Incubation Services in Kenya. *International Journal of Business Administration*, *2*(4), 112–121. https://doi.org/10.5430/ijba.v2n4p112

Meru, A. K., & Struwig, M. (2015). Business-Incubation Process and Business Development in Kenya: Challenges and Recommendations. *Journal of Entrepreneurship and Innovation in Emerging Economies*, *1*(1), 1–17. https://doi.org/10.1177/2393957514554982

Mian, S. A. (2011). University's involvement in technology business incubation: what theory and practice tell us? *International Journal of Entrepreneurship and Innovation Management*, *13*(2), 113. https://doi.org/10.1504/IJEIM.2011.038854

Mian, S. A. (2014). Business incubation mechanisms and new venture support: emerging structures of US science parks and incubators. *International Journal of Entrepreneurship and Small Business*, *23*(4), 419. https://doi.org/10.1504/IJESB.2014.065682

Mian, S. A., Corona, L., & Doutriaux, J. (2010). Building knowledge regions in developing nations with emerging innovation infrastructure : evidence from Mexico and Pakistan. *International Journal of Innovation and Regional Development*, *2*(4), 304–330. https://doi.org/10.1504/IJIRD.2010.037884

Mian, S. A., Fayolle, A., & Lamine, W. (2012). Building sustainable regional platforms for incubating science and technology businesses Evidence from US and French science and technology parks. *The International Journal of Entrepreneurship and Innovation*, *13*(4), 235–247. https://doi.org/10.5367/ijei.2012.0100

Mian, S. A., Lamine, W., & Fayolle, A. (2016). Technology Business Incubation: An overview of the state of knowledge. *Technovation*, *50–51*, 1–12. https://doi.org/10.1016/j.technovation.2016.02.005

mLab. (2011). m:Lab East Africa Launch. Retrieved September 27, 2017, from https://www.mlab.co.za/mlab-east-africa-launch/

Mowery, D. C., & Sampat, B. N. (2004). The Bayh-Dole Act of 1980 and University–Industry Technology Transfer: A Model for Other OECD Governments? *The Journal of Technology Transfer*, *30*(1–2), 115–127.

Mwobobia, F. M. (2012). The Challenges Facing Small-Scale Women Entrepreneurs: A Case of Kenya. *International Journal of Business Administration*, *3*(2), 112–121. https://doi.org/10.5430/ijba.v3n2p112

Nowak, M. J., & Grantham, C. E. (2000). The Virtual Incubator: Managing Human Capital in the Software Industry. *Research Policy*, *29*(2), 125–134.

NSTEDB. (2009). First Status Report on Technology Business Incubation in India. Retrieved September 21, 2017, from http://www.nstedb.com/fsr-tbi09/main.html

NSTEDB. (2014). Fuelling Entrepreneurship- The Story of Technology Business Incubation in India. Retrieved September 26, 2017, from http://www.nstedb.com/booklet.pdf

OECD. (2002). *Small and Medium Enterprise Outlook* . Paris: OECD.

Oliviera, J. B., & Menck, A. C. M. (2008). Towards a Supply-Demand Model for Incubators Success–A Cases' Study in Brazil. In *XXV IASP World Conference on Science and Technology Parks*. Johannesburg.

Orodho, J. A. (2009). *Elements of Education and Social Science Research Methods.* Nairobi/Maseno.

Peters, L., Rice, M., & Sundararajan, M. (2004). The Role of Incubators in the Entrepreneurial Process. *Journal of Technology Transfer*, *29*(1), 83–91.

Pompa, C. (2013). Literature Review on the Impact of Business Incubation , Mentoring , Investment and Training on Start-up Companies. *EPS PEAKS-- Economic and Private Sector Professional Evidence and Applied Knowledge Services*.

Portes, A. (1998). Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology*, *24*(1), 1–24. https://doi.org/10.1146/annurev.soc.24.1.1

Putnam, R. (2001). Social capital: Measurement and consequences. *Canadian Journal of Policy Research*, *2*(1), 41–51.

Roberts, E. B., & Eesley, C. (2009). Entrepreneurial Impact: The Role of MIT. Retrieved September 24, 2017, from http://www.kauffman.org/what-we-do/research/2009/08/entrepreneurial-impact-the-role-of-mit

Sá, C. M. (2015). Perspective of Industry's engagement with African Universities. *Draft Report for the Africa Association of Universities*.

Saunders, M., Lewis, P., & Thornbill, A. (2016). *Research Methods for Business Students* (7th ed.). Edingburg Gate, England: Pearson Professional Limited.

Scaramuzzi, E. (2002). *Incubators in Developing Countries : Status and Development Perspectives*. Washington, DC.

Schwartz, M. (2011). Incubating an illusion? Long-term incubator firm performance after graduation. *Growth and Change*, *42*(4), 491–516. https://doi.org/10.1111/j.1468-2257.2011.00565.x

Shan, W. (1990). An empirical analysis of organizational strategies by entrepreneurial high-technology firms. *Strategic Management Journal*, *11*(2), 129–139.

Somsuk, N., Punnakitikashem, P., & Laosirihongthong, T. (2010). Determining enabling factors of University Technology Business Incubation program: Resource-based view theory. In *IEEM2010 - IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 1032–1037). IEEE. https://doi.org/10.1109/IEEM.2010.5674238

Tamásy, C. (2007). Rethinking technology-oriented business incubators: Developing a robust policy instrument for entrepreneurship, innovation, and regional development? *Growth and Change*, *38*(3), 460–473. https://doi.org/10.1111/j.1468-2257.2007.00379.x

Thillairajan, A., & Jain, A. (2013). New and Nascent Enterprises: *Analysis of Incubation Support in India*. *The Journal of Private Equity*, *16*(3), 69–85. https://doi.org/10.3905/jpe.2013.16.3.069

Wachira, K., Ngugi, P., & Otieno, R. O. (2016). Role of Social Networks in

University Based Business Incubators in Promoting Entrepreneurship Growth in Kenya. *International Journal of Academic Research in Business and Social Sciences*, *6*(1), 1–15. https://doi.org/10.6007/IJAREMS/v6-i1/2558

Wachira, K., Ngugi, P., & Otieno, R. O. (2017a). Incubatee Selection Criteria and its Role on Entrepreneurship Growth : A Survey of University Based Business Incubators in Kenya. *International Journal of Academic Research in Business and Social Sciences*, *7*(1), 28–38. https://doi.org/10.6007/IJARBSS/v7-i1/2553

Wachira, K., Ngugi, P., & Otieno, R. O. (2017b). The role of university based business incubators strategy on enterprise growth in Kenya. Retrieved September 21, 2017, from http://ir.jkuat.ac.ke/bitstream/handle/123456789/3305/kevin wachira Phd Entrepreneurship 2017.pdf?sequence=1&isAllowed=y

WEF. (2013). Global Information Technology Report. Retrieved September 24, 2017, from www3.weforum.org/docs/WEF_GITR_Report_2013.pdf

WEF. (2016). Global Information Technology Report. Retrieved September 26, 2017, from http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf

WEFD. (2015). Women Enterprise Fund. Retrieved March 17, 2018, from http://www.wef.co.ke/

Weijters, B., & Baumgartner, H. (2012). Misresponse to reversed and negated items in surveys: A review. *Journal of Marketing Research*, *49*(5), 737–747.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Woolcock, M., & Narayan, D. (2000). Social Capital: Implications for Development Theory, Research, and Policy. *The World Bank Research Observer*, *15*(2), 225–249. https://doi.org/10.1093/wbro/15.2.225

YEDF. (2016). Youth Enterprise and Development Fund. Retrieved March 5, 2018, from http://www.youthfund.go.ke/

APPENDICES

APPENDIX I: RESEARCH FACILITATION LETTER

Strathmore Business School

Tuesday, 13th March 2018

To whom it may concern

RE: FACILITATION OF RESEARCH – GEORGE MURAGE

This is to introduce George Murage, who is a Master of Business Administration student at Strathmore Business School, admission number MBA/91151/16. As part of our MBA Program, George is expected to do applied research and to undertake a project. This is in partial fulfilment of the requirements of the MBA course. To this effect, he would like to request for appropriate data from your organization.

George is undertaking a research paper on-: "Effect of University Technology Business Incubator services on the performance of digital entrepreneurship in Kenya". The information obtained from your organization shall be treated confidentially and shall be used for academic purposes only.

Our MBA seeks to establish links with industry, and one of these ways is by directing our research to areas that would be of direct use to industry. We would be glad to share our findings with you after the research, and we trust that you will find them of great interest and of practical value to your organization.

We appreciate your support and we shall be willing to provide any further information if required.

Yours sincerely,

Muriithi Njogu.
Director – MBA Programs

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APPENDIX II: QUESTIONNAIRE FOR DIGITAL START-UPS

Welcome to this survey

This questionnaire is part of a study assessing the effect of University Technology Business Incubator services on the performance of digital enterprises in Kenya. You have been selected to take part in the survey. The survey will take 10 minutes to complete. The responses which are entirely voluntary will be kept confidential and will only be used for purposes of this study. Thank you in advance for taking time to fill in the questionnaire.

Section A: Background Information

What is your age?

- ◯ 18 to 25 years
- ◯ 26 to 35 years
- ◯ 36 to 45 years
- ◯ 46 years and over

What is your gender?

- ◯ Female
- ◯ Male

What is the highest level of education you have completed?

- ◯ Primary
- ◯ Secondary
- ◯ Tertiary
- ◯ Bachelor's Degree
- ◯ Master's Degree
- ◯ Doctorate
- ◯ Other (please specify)

When did your company join and exit the incubator?

Entry Date

DD/MM/YYYY

Exit Date

DD/MM/YYYY

Please give a brief description of your business

What is the main technology area for your innovation?

- ◯ Internet-based - Web Application only
- ◯ Mobile-based - SMS, USSD, IVR, Android/IOS App only
- ◯ Both Internet-based and Mobile-based application
- ◯ Other (please specify)

Section B1: Incubator Services - Technological Support

How important is technical training to your start-up?

- ◯ Not at all important
- ◯ Not so important
- ◯ Somewhat important
- ◯ Very important
- ◯ Extremely important

To what extent you do you agree with the following statements on infrastructure and technical training?

	Strongly disagree	Disagree	Can't say	Agree	Strongly agree
The physical facilities such as work-spaces were critically important in the early days of my start-up	○	○	○	○	○
Access to university laboratories and/or scientific equipment was very important for my product research and development	○	○	○	○	○
I rarely used the university laboratories and/or scientific equipment	○	○	○	○	○
The technical training provided was relevant to my innovation	○	○	○	○	○
The university faculty were subject-matter-experts in my innovation area	○	○	○	○	○

Section B2: Incubator Services - Business Support

To what extent do you agree with the following statements on business training?

	Strongly disagree	Disagree	Can't say	Agree	Strongly agree
I can prepare a business plan on my own	○	○	○	○	○
I can prepare a marketing plan for my products / services	○	○	○	○	○
I don't understand the legal requirements to register my business	○	○	○	○	○
I understand basic accounting and can interpret financial statements	○	○	○	○	○
I know how to build and maintain a high-performance team	○	○	○	○	○
I understand how to protect my invention using patents and trademarks	○	○	○	○	○

To what extent do you agree with the following statements on entrepreneurship mentoring?

	Strongly disagree	Disagree	Can't say	Agree	Strongly agree
Entrepreneurial mentoring enabled me to better evaluate the business opportunities for my innovation	☐	☐	☐	☐	☐
The mentoring helped me develop a profitable business model for my product or service	☐	☐	☐	☐	☐
Entrepreneurial mentoring pointed out weaknesses and knowledge gaps for me to address	☐	☐	☐	☐	☐
The mentoring refined and focused the strategy for my business	☐	☐	☐	☐	☐
The mentoring deepened my understanding on how to grow and scale my start-up	☐	☐	☐	☐	☐
My incubator mentor regularly monitored my progress	☐	☐	☐	☐	☐

The incubator provided information on how to access the Youth Enterprise Development Fund and/or Women Enterprise Fund

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

How helpful was your incubator management in preparing your start-up for funding?

- ☐ Not at all helpful
- ☐ Not so helpful
- ☐ Somewhat helpful
- ☐ Very helpful
- ☐ Extremely helpful

The incubator facilitated sufficient contact with potential financiers for my start-up

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

How useful was the incubator in helping you understand the critical areas investors look at when funding start-ups?

- ◯ Not at all useful
- ◯ Not so useful
- ◯ Somewhat useful
- ◯ Very useful
- ◯ Extremely useful

Section B3: Incubator Services - Access to Networks

To what extent do you agree with the following statements on networking with business professionals?

	Strongly disagree	Disagree	Can't say	Agree	Strongly agree
Networking with business professionals gave me access to resources beyond those provided by my incubator	◯	◯	◯	◯	◯
Networking with business professionals gave me access to key business partners and professionals	◯	◯	◯	◯	◯
Networking with business professionals improved the image of my firm as a legitimate business	◯	◯	◯	◯	◯
I have a strong connection with business partners and professionals who are important to my business	◯	◯	◯	◯	◯

How frequently did you interact with the following parties?

	Daily	Weekly	Monthly	Longer than a Month	Not at all
Incubator mentor	◯	◯	◯	◯	◯
Business professionals	◯	◯	◯	◯	◯
University faculty and staff	◯	◯	◯	◯	◯
Financiers	◯	◯	◯	◯	◯

To what extent do you agree with the following statements on networking with financiers and university faculty?

	Strongly disagree	Disagree	Can't say	Agree	Strongly agree
Networking with university faculty did not increase the level of innovation for my product	○	○	○	○	○
Networking with university faculty facilitated increased R&D collaboration	○	○	○	○	○
I have a weak connection with university faculty	○	○	○	○	○
Networking with financiers helped me obtain funding for my business	○	○	○	○	○
I have a strong connection with financiers	○	○	○	○	○

Section C: Business Performance

After incubation the growth of sales in my business has increased

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

What has been your average annual percentage growth in sales after incubation?

After incubation my company has created new jobs

- ○ Strongly disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

How many employees in the following job roles have you hired in your company, after graduating from the incubator?

Management Role	
Technical Role	
Business Role	
Contract / Temporary Role	
Other Roles (Specify)	

How many employees are from the hosting university?

After incubation the number of products / services or product features produced by my firm has increased

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neither agree nor disagree
- ◯ Agree
- ◯ Strongly agree

After incubation how many patents, trademarks and trade secrets have you registered or currently hold?

Number of Patents	
Number of trademarks	
Number of trade secrets	

Over the last 12 months, how many new products, services, or product updates have you introduced in the market?

After incubation, how long does it take to introduce a new product feature or product update?